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ECONOMIC AFFAIRS

No. 1074



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CONTENTS

ECONOMIC POLICY, ORGANIZATION AND MANAGEMENT

Annual Meeting of Economics Department of USSR Academy
of Sciences

(EKONOMIKA I MATEMATICHESKIYE METODY, No 4,
Jul-Aug 83)..... 1

RESOURCE UTILIZATION AND SUPPLY

Importance of Economic Balances Stressed

(MATERIAL'NO-TEKHNICHESKOYE SNABZHENIYE, No 4, 7,
Apr, Jul 83)..... 11

Consumer Ranks High, by B. Smekhov
Industry-Demand Tradeoffs, by Yu. Lapchenko

ECONOMIC MODELING AND COMPUTER TECHNOLOGY APPLICATION

Balance Method for Modeling National Economic Ties

(M. Melikhov; VESTNIK STATISTIKI, No 7, Jul 83)..... 24

INTRODUCTION OF NEW TECHNOLOGY

Multifaceted Problems Relating to New Technology Reviewed

(IZVESTIYA AKADEMII NAUK SSSR. SERIYA EKONOMICHESKAYA,
No 5, Sep-Oct 83)..... 34

Economic Contradictions, by V.M. Likhtenshteyn
Evaluation of Economic Efficiency, by S.A. Nikitin,
Ya. V. Safronov
Optimization of Service Life, by N.P. Makarkin

ECONOMIC POLICY, ORGANIZATION AND MANAGEMENT

ANNUAL MEETING OF ECONOMICS DEPARTMENT OF USSR ACADEMY OF SCIENCES

Moscow EKONOMIKA I MATEMATICHESKIYE METODY in Russian No 4, Jul-Aug 83 pp 721-727

[Article: "The General Annual Assembly of the Economics Department of the USSR Academy of Sciences"]

[Text] In opening the General Annual Assembly of the Economics Department of the USSR Academy of Sciences on 1 March 1983, Academician N. P. Fedorenko dwelled in his opening address on some aspects of the life and activity of Karl Marx, the 165th anniversary of whose birth and the 100th anniversary of whose death all progressive mankind is celebrating.

In the report of Corresponding Member of the USSR Academy of Sciences Ye. I. Kapustin, which was devoted to the economic teachings of K. Marx and the urgent problems of the political economy of socialism, it was emphasized that the economic theory of K. Marx is an integral component and the main content of Marxism. Its essence consists, first of all, in the scientific substantiation of the inevitability of the downfall of capitalism and the transition to a new social system. The underlying theses, which are necessary for the understanding of the essence of the economic categories of the transitional period from capitalism to socialism and of the lowest and highest phases of the communist mode of production, were developed by K. Marx. These theses were developed and clarified by V. I. Lenin with allowance made for new historical facts and the experience of building socialism.

Today we rely on the teachings of K. Marx and Marxism-Leninism in solving the urgent problems of mature socialist society, when analyzing new facts and the real contradictions of socioeconomic development, when identifying the objective laws and the means of their planned use in the building of the material and technical base of communism and further improving socialist production relations.

First of all the methodology of K. Marx, which was brilliantly used by him in the work on "Kapital" [Capital], lies at the basis of the political economic studies of Soviet scholars. Such methodological principles of "Kapital" as the unity of the historical and the logical, the examination of the system of production relations as an organic integrity with the basic economic law--the law of its movement, of the internal contradictions of production relations as the source of their development, also found their comprehensive application in the political economy of socialism. Experience attests that the underestimation of the methodology of K. Marx inevitably decreases the value of the results of a political economic study, and at times can also create the danger of the spread of alien views and conceptions.

The definition by K. Marx of the very subject of political economy as a science, which studies production relations and the economic laws which express their essence, is important. These fundamental theses also serve today as the theoretical and methodological basis of the proper understanding of the subject, the basic tasks and the directions of the further development of the political economy of socialism. K. Marx did not limit himself to the analysis of individual aspects of capitalist production relations, but regarded as absolutely necessary the study of their entire set. He always analyzed production relations in their interrelationship with the productive forces of society, revealing the decisive influence of the latter; at the same time he devoted enormous attention to the interaction of production relations, the economic basis of society with the system of social relations, the phenomena and institutions of the superstructure.

All this is of enormous importance for the political economic studies of mature socialist society. It is possible to properly understand and to ensure systematically the further improvement of socialist production relations and to increase their active influence on the development of the productive forces of society only by studying them in the fundamental interaction with productive forces, with the achievements of the scientific and technical revolution during the building of the material and technical base of communism. It is necessary to continue the studies of the interaction of the base and the superstructure, the economic role of the socialist state, the conditions of the strengthening and further development of the socialist way of life and the social homogeneity of our society. In recent years a significant step forward has been made in this direction. Each economic decision, the application of new economic methods and the use of new equipment and technology are being viewed more and more from the point of view of social tasks.

The further improvement of the management of the national economy is one of the most important conditions of the increase of the efficiency of socialist production in the direction of its utmost intensification. It should be based on a thorough political economic analysis of the entire system of production relations and those changes which are occurring in them.

On the basis of this the speaker analyzed in detail the problems connected with the new level of the socialization of socialist production, the increase of the efficiency of the functioning of the agro-industrial complex, the process of the development and improvement of public ownership, the strengthening of conformity to a plan in the development of the economy, socialist competition, the efficient use of commodity-money relations, the increase of labor productivity and others.

In conclusion Ye. I. Kapustin stressed that economics scholars should, following the example of V. I. Lenin, when working on the most urgent problem, "consult" K. Marx and F. Engels and use creatively the teachings of Marxism in one specific situation or another. This is an objective necessity of the further development of research in the area of political economy, the need for which is being urgently felt by the Communist Party, as well as a condition of the development of Marxist-Leninist science as a whole, any underestimation of the role of which, "of its creative development, the narrow pragmatic interpretation of its tasks, the contempt for fundamental problems of theory, the domination of opportunism or scholastic theorizing are fraught," as General Secretary of the CPSU Central Committee Comrade Yu. V. Andropov noted, "with serious political and ideological consequences" [Yu. V. Andropov, "The Teachings of Karl Marx and Some Questions of the Building of Socialism in the USSR," *KOMMUNIST*, No 3, 1983, p 21].

Academician N. P. Fedorenko, academician secretary of the Economics Department, delivered the accountability report on the work of the Economics Department of the USSR Academy of Sciences during 1982. The speaker recalled the requirement of the November (1982) CPSU Central Committee Plenum: "The main thing is... to expedite the work on the improvement of the entire system of the management of the economy--administration, planning, the economic mechanism."

The scientific collectives of the department continued to work in 1982 in conformity with the Basic Directions of the Work of the Economics Department of the USSR Academy of Sciences on the Fulfillment of the Decisions of the 26th CPSU Congress, as well as the plan of scientific research work in the area of the natural and social sciences for 1981-1985. Definite results were achieved with respect to all the comprehensive research programs.

During the past year work was performed vigorously on the Comprehensive Program of Scientific and Technical Progress. Conceptions of all the socioeconomic sections of the program were prepared, discussed and approved, their drafts were discussed in the bureau of the department, the basic provisions of the consolidated socioeconomic section were formulated. The Presidium of the USSR Academy of Sciences submitted to the USSR State Planning Committee suggestions on the conception of the economic and social development of the USSR to 2000. In contrast to past years the institutes of the republic academies, the territorial departments and affiliates of the USSR Academy of Sciences were involved in this work.

Considerable research was performed to execute the decisions of the May (1982) CPSU Central Committee Plenum on the Food Program, the regional problems and social aspects of the development of the agro-industrial complex of the country. The preparation for important experiments, in which, in particular, the checking of the possibilities of the use under our conditions of individual elements of the experience of Hungary, Bulgaria and the GDR in the organization of agricultural production is envisaged, was carried out in the area of the improvement of the economic mechanism of the agro-industrial complex.

In the studies in accordance with the program "The Economic Problems of Mature Socialism and the Laws of Its Development Into Communism" particular attention was devoted to those questions of political economy, which are directly connected with practice and find their reflection in the further improvement of the management of the national economy, the increase of the efficiency of social production, the acceleration of scientific and technical progress and the development of socialist competition. The Institute of Economics of the USSR Academy of Sciences prepared the three-volume work "Ekonomicheskiy stroy sotsializma" [The Economic System of Socialism], in which there are examined the problems of: 1) the creation of the material and technical base of communism and the development of socialist production relations into communist production relations; 2) socialist reproduction; 3) the use of the economic laws of socialism in the economic practice of mature socialist society.

Within the framework of the program "The Development of the Theory and Methodology of the Planning and Management of the Socialist Economy" the goal program methods of planning underwent further development, a number of methodological documents on the compiling of programs and the management of their implementation on both the sectorial and territorial level were prepared. As a result of the cooperation of

scientists of the Economics Department, first of all the Central Institute of Economics and Mathematics and the Institute of Economics and the Organization of Industrial Production, with staff members of the Main Computer Center of the USSR State Planning Committee the model apparatus of the automated system of planning calculations was enlarged; a number of practical and experimental calculations were made. The Institute of Economics and the Organization of Industrial Production published the monograph "Ekonomiko-matematicheskiye metody i modeli v perspektivnom otraslevom planirovanii" [Mathematical Economic Methods and Models in Long-Range Sectorial Planning]. Last year the Central Institute of Economics and Mathematics completed for the most part the work on the series of collective monographs "Voprosy optimal'nogo planirovaniya i upravleniya sotsialisticheskoy ekonomikoy" [Problems of the Optimum Planning and Management of the Socialist Economy], the first volume of which has already been published. Two monographs of a three-volume series, which is devoted to the problems of the improvement of the management of the socialist economy, in the preparation of which a collective of authors from the USSR and several European socialist countries participated, have been published.

In speaking about the program "Theoretical Problems of the Efficiency and Intensification of Social Production," N. P. Fedorenko mentioned the successfully launched research on the development of a comprehensive method of the evaluation of the effectiveness of economic measures. The recent discussion of the draft of the method showed that considerable work still lies ahead here, but the keys to the problem, in the opinion of the speaker, for the most part have been found.

Active work is being performed on the programs "Problems of Demography," in the work on which the participation of Ukrainian economists and demographers has increased, and "Problems of the Distribution of Productive Forces and the Development of Regions." The Council for the Study of Productive Forces has prepared a version of the diagram of the distribution of the productive forces of the USSR for the period to 2000. The work in the area of regional development has assumed a particular scope in connection with the compilation within the framework of the Comprehensive Program of Scientific and Technical Progress of the corresponding republic, regional and oblast programs.

Finally, the research on the programs "The Laws of the Development of the World Socialist Economy, the Problems of Socialist Economic Integration and the Development of the Long-Term Economic Relations of the USSR With the Socialist Countries" and "The Laws and Trends of the Development of the Economy of Capitalist and Developing Countries" was continued during the year under review. Of the numerous achievements of the collectives of our experts in international economics in this direction the speaker singled out the basic work "Mirovyye sotsialisticheskoye khozyaystvo. Voprosy politicheskoy ekonomii" [The World Socialist Economy. Problems of Political Economy].

In examining the tasks facing economics scholars, N. P. Fedorenko emphasized the need for the substantial increase of the level of the scientific studies of both the general theoretical problems of the economic development of socialist society and the specific tasks of the planning and management of the national economy. The elimination of the shortcomings, which still exist in the economic mechanism, and the overcoming of some negative trends of the development of the economy, which have become noticeable in recent years, in many ways depend on economic science. The

speaker singled out the most important directions, on which the efforts of economists should be concentrated first of all.

The conception of the socialist way of life in all its aspects--material well-being and spiritual development, the relations of distribution, the conditions of the increase of the efficiency of labor and so on--requires elaboration. It is necessary to take part in the substantiation of demographic policy, the policy of efficient employment, the distribution of monetary income and the development of the forms of consumption, the study of the problems of urbanization and ecology. In short, the studies of the social aspects of the economic development of our society are being brought to the forefront, and the main role in them should belong to the Institute of Economics of the USSR Academy of Sciences; the Institute of Socioeconomic Problems of the USSR Academy of Sciences (Leningrad), as well as the institutes of economics of the republic academies can also do much.

The speaker grouped with the basic tasks of scientific research the substantiation of the means of the changeover of our economy to the intensive means of development. Further work on the Comprehensive Program of Scientific and Technical Progress and its socioeconomic aspects lies ahead.

The compilation and implementation of such goal programs of national economic importance as the Food Program, the energy program and others will hold a special place in the substantiation of the directions of the intensification of social production. The recommendations of scientists on the effective development of the major spheres of the national economy, the saving of production resources and the leading increase of its end results should be embodied in them.

The research on the problems of the reproduction of manpower resources, fixed capital and capital investments and the efficient use of natural resources should be intensified for the purpose of determining the specific means of changing over to the intensive type of economic growth.

The most important direction of scientific research, which requires the joint efforts of all economic institutes, is the further improvement of the system of the planning, management and organization of the national economy. Among the tasks, which should be accomplished when improving the mechanism of management, there are: 1) the strengthening of the centralized management of the economy by means of methods which ensure the achievement of the social goals of the building of communism on the basis of the planned balanced development of the national economy and the increase of its efficiency; 2) the increase of labor activeness in the public sector, the creation of a genuine interest of the working people in the end results of production; 3) the overcoming of departmentalism and regionalism, the disconnection of the interests of the basic economic units, which is manifested in the tendencies to demand a bit more from the state, but to give it a bit less.

Under the formed conditions a set of interconnected measures, which are implemented in advance, is needed in order to accomplish these tasks. Taking into account the experience of the work on the Comprehensive Program of Scientific and Technical Progress, the speaker proposed to include in this set the following basic measures.

1. The decisive turn of planning toward economic methods of influencing the economy, the overcoming of the discrepancy between the units of the plan and the

economic conditions of their implementation, the assurance of the stability and practicability of the plans, the turning of the five-year plan into really the main type of state planning. For this it is necessary: to decrease the number of volume indicators, which are planned for instruction, to replace a portion of them with prices for the most important products, which are specified in the plan, and other long-term standards (the fee for production resources, the wage, the distribution of the profit); to improve markedly the quality of financial planning; to plan all payment transactions in the state, including the income of enterprises and the population.

2. The conversion of associations and enterprises to complete cost accounting, the extension of their independence with the simultaneous increase of economic liability by the systematic influencing of the conditions of their activity.

3. The improvement of pricing as one of the main factors of the formation of such conditions; the changeover from expenditure prices to the prices of the plan balance, which reflect the total impact and the shortage of products.

4. The improvement of the system of the distribution of resources and material and technical supply: the turning of direct economic relations, which permit the choice of suppliers, as well as wholesale trade in means of production into the main forms of supply and marketing.

5. The improvement of the wage system; the linking of the wage with the end results; the increase for these purposes of the role of the wage rate system, the rejection of the simultaneous revision of the wage rate conditions and budget financing, the increase of wage rates and salaries; the development of cost accounting brigades and internal economic cost accounting.

6. The further coordination of the system of social security, the financing of housing construction, the payment for housing and municipal services with the requirements of distribution according to labor.

7. The improvement of the financial and credit system for the purpose of the stimulation of financial and credit levers of the increase of production efficiency and the increase of the responsibility of cost accounting units, the assurance of the commodity-money balance of the national economy, for which it is necessary to delimit realistically the resources of the budget, the loan fund and cost accounting units; the revenues of the budget and the credit resources of the bank should have realistic and economically justified sources.

8. The improvement of the organizational structure of management in order: to implement the principle of mutual material liability in the interrelations of superior economic organs with subordinate enterprises, to guarantee economically and legally the observance of the rights of the latter, to achieve the overcoming of departmentalism, high-handed action and bureaucracy; to simplify the structure of management.

9. The increase of the level of the organization of management, the active introduction of mathematical economic methods in planning practice, the development of information support on the basis of the extensive use of computers, the increase of the efficiency of automated control systems of all levels, the creation of a state-wide system of the gathering and processing of information (OGAS) on the basis of

a network of collective-use computer centers, the considerable improvement of computer facilities and peripheral equipment, the development of standard computer software and economic planning calculations.

The implementation of this most complex set of measures should be carried out on the basis of the Comprehensive Program of the Improvement of the System of Management of the National Economy, in which the sequence of the measures being implemented would be coordinated and the corresponding material prerequisites would be prepared. One of its main tasks is to create the necessary "starting" conditions of such functions of the management mechanism, which would meet the requirements of the intensification of the economy of mature socialism.

The primary measures in the area of the management of the economy and the preparation for its reorganization should first of all improve the material and financial balance of the national economy.

The research on the improvement of the economic mechanism should be related directly to practice, maintaining constant contacts with the USSR State Planning Committee, the State Committee for Science and Technology, the State Committee on Prices and other central departments and taking part in the economic experiments in individual regions and associations.

The speaker noted that in recent times the department has devoted much attention to the implementation of the results of economic studies in the national economy. The contacts and interrelations of the institutes with planning and management organs have been strengthened appreciably. For example, the Central Institute of Economics and Mathematics alone during 1976-1982 had about 130 clients at all levels of the national economy, among which there are: the State Planning Committee, the State Committee for Material and Technical Supply, the State Committee for Standards, the State Committee on Prices, the State Committee for Labor and Social Problems, the State Bank, the Ministry of Finance and others. The forms of the contacts and joint work of the collectives of the institutes with planning and management organs, plants and associations are diverse: on the basis of specific assignments of supervisory organs, economic contracts, agreements on scientific and technical cooperation, consultative assistance. The practice of setting up temporary task forces, which are made up of specialists on some problems or others for the effective accomplishment of specific tasks, has been expanded.

N. P. Fedorenko also dwelled on the coordinating activity of the department--the compiling of plans and programs and the monitoring of their implementation, the discussion in the bureau of the department of the reports of institutes, particularly republic institutes; the holding of conferences of directors, field meetings of the bureau. The need for the more distinct delimitation in the republics of the directions of activity between academic and other scientific institutions of the economic type was specially pointed out.

Academician T. S. Khachaturov (Moscow State University), who spoke during the discussion of the accountability report, dwelled on the questions connected with the drafting of the Comprehensive Method of Evaluating the Effectiveness of Economic Measures.* He recalled that the third edition of the Standard Method of

*On the conference, at which the draft of this method was discussed, see the report of G. I. Mikerin in this issue.

Determining the Economic Effectiveness of Capital Investments, which is also of a comprehensive nature, has already been prepared, the problems of the effectiveness of capital investments in the production and nonproduction spheres, circulation, scientific research work, the use of nature and environmental protection are examined in it. T. S. Khachaturov gave a critique of the Comprehensive Method. He agreed with individual provisions of it, particularly on the recording of non-simultaneous expenditures and the actual effectiveness, but objected to proceeding from the inclusive expenditures and to the comparison of the versions on the integral impact "according to a very complicated formula" and others.

V. V. Ostrovskiy (Institute of Economic Problems of the Development of the Agro-Industrial Complex of the USSR Academy of Sciences, Saratov) told about the results of 2 years of work of the new institute. A coordinating council has been set up, a coordinating plan has been drafted, a conference on the comprehensive goal planning of the agro-industrial complex has been held. Contacts are being established with the Central Institute of Economics and Mathematics, the Institute of Economics of the USSR Academy of Sciences, the Institute of Economics and the Organization of Industrial Production and others. The sectorial and organizational management structure of the agro-industrial complex of a region and a system of indicators of the final product of this complex have been elaborated, a report on the regional problems of the substantiation of the Food Program has been prepared. The institute is devoting considerable attention to the social and demographic problems of the countryside. The main difficulties today are the lack of personnel and computer facilities. Concluding his statement, V. V. Ostrovskiy proposed to endorse the activity of the Economics Department of the USSR Academy of Sciences in 1982.

Academician L. V. Kantorovich (All-Union Scientific Research Institute of Systems Research) noted that the combining of the forces of not only economists themselves, but also mathematicians, cyberneticists and representatives of the natural, especially the technical sciences is necessary for the further development of economic science, and endorsed the activity of the department in 1982. He did not agree with the appraisal of the draft of the Comprehensive Method of Evaluating the Effectiveness of Economic Measures, which was expressed by T. S. Khachaturov. L. V. Kantorovich stressed that under the conditions of economic interrelations, which are becoming more and more complicated, the intensification of scientific and technical progress, the worsening of the situation with resources and so forth the appraisal of economic measures from a common point of view, moreover, the appraisal of the effectiveness of not only capital investments, not only new equipment, but also the work of enterprises in the area of ecology, manpower resources and so forth, are acquiring great importance. The urgency of the Comprehensive Method is determined by this. L. V. Kantorovich said that all those who wish to could have taken part in the discussion of the draft of this method; recently at the conference* he himself expressed his critical remarks on this method. It is at the stage of drafting, it is necessary to do more work on it, but this is an important and necessary document.

Academician A. G. Aganbegyan (Institute of Economics and the Organization of Industrial Production) endorsed the activity of the department and stressed that its merit consists first of all in the combining of the efforts of economists. The Comprehensive Program of Scientific and Technical Progress and Its Socioeconomic

*See the footnote on the preceding page.

Consequences, the proposals on the improvement of the system of management of the economic mechanism and other works of recent years, which unite different institutes, have increased the prestige of the Economics Department and have attracted the attention of specialists of the natural and technical sciences to economic problems. Such practical cooperation of scientists began after the awarding in 1965 of the Lenin Prize to Academician L. V. Kantorovich, Academician V. S. Nemchinov and Professor V. V. Novozhilov for their classical works in the area of optimum planning, the awarding which in essence ended the frequently excessively pointed debates of those years. It is necessary to maintain the spirit of cooperation, which has now been established.

A. G. Aganbegyan recalled that the decision on the formulation of the Comprehensive Method of Evaluating the Effectiveness of Economic Measures was made by the USSR State Committee for Science and Technology and the Presidium of the USSR Academy of Sciences. The need for a unified national economic approach to the determination of economic effectiveness, which had already been substantiated by V. V. Novozhilov, was at the basis of this decision. Only a method, which appraises economic measures from a common point of view and reduces all expenditures to a common measure, can be called comprehensive.

The discussion of the draft of the Comprehensive Method, which took place in public both in the commission, which included representatives of various views and approaches (including members of the Scientific Council for the Effectiveness of Capital Investments), and at the conference, showed its main merit: it provides practice with clear criteria of the evaluation of the effectiveness of economic measures. It can be said that this method is complicated and requires some modifications. It is possible to argue whether the method should be approved as an instructional document or should be a document which sets forth the scientific principles by which it is necessary to be guided when elaborating special methods. But these are already different questions.

Corresponding Member of the USSR Academy of Sciences S. S. Shatalin (All-Union Scientific Research Institute of Systems Research) fully supported the appraisal of the activity of the department in 1982, which was given by Academician L. V. Kantorovich and Academician A. G. Aganbegyan. He called upon all economists to unite for the further development of the Comprehensive Program of Scientific and Technical Progress and for the careful study of the problems of the development of the public ownership of the means of production and the construction of an economic mechanism which is equal to the present type of socioeconomic development of the country, which were raised in the article of Comrade Yu. V. Andropov ("The Teachings of Karl Marx and Some Questions of the Building of Socialism in the USSR," *KOMMUNIST*, No 3, 1983). The Comprehensive Method is of the greatest importance for the development of such a mechanism. Here is not the place to discuss the individual special problems which are touched upon by it--this must be done at conferences and on the pages of the scientific press. However, it is possible to state that the representatives of the different directions of economic science, who took part in the discussion of its draft, were constructive in their remarks and wishes. The joint work in this direction should be continued.

The assembly also heard the report of Academician V. P. Mozhin of the All-Union Academy of Agricultural Sciences imeni V. I. Lenin, which was devoted to the 60th anniversary of the USSR and to the socioeconomic development of the union republics.

The results of the scientific research work of economic institutions and the scientific organizational activity of the Economics Department of the USSR Academy of Sciences during 1982 were approved in the decree of the General Assembly. The implementation of the decisions of the 26th CPSU Congress, the May and November (1982) CPSU Central Committee Plenums and the Basic Directions of the Work of the Economics Department of the USSR Academy of Sciences on the Development of Economic Science in Light of the Decisions of the 26th CPSU Congress was indicated as the most important task of the scientific institutions of the department. It is recommended to continue the further elaboration of the problems connected with the implementation of the Food Program. The scientific institutions of the department were ordered to concentrate efforts on the continuation of the elaboration of the most important socioeconomic programs:

the economic problems of mature socialism and the laws of its development into communism;

the theory and methods of the planning and management of the socialist economy;

the theoretical problems of the efficiency and intensification of production;

the regional economy and the regional socioeconomic development of the USSR for the future to 2000, the formation and development of large national economic complexes;

the laws of the development of the world socialist economy, the problems of socialist economic integration and the development of the long-term economic relations of the USSR with the socialist countries;

the laws and trends of the development of the economy of the capitalist and developing countries and the world capitalist economy, the problems of the foreign economic relations of the USSR with these countries.

In the area of political economy it is planned to study: the methodological economic problems of mature socialism, the general laws and peculiarities of the building of mature socialism in the countries of the socialist community, the social and economic problems of the scientific and technical revolution and the improvement of distributive relations. The study of the theoretical legacy of K. Marx in economic science has to be intensified.

In the decree it is recommended to continue the elaboration of the problems of the optimum planning of the socialist economy, theoretical questions and procedural recommendations on the fitting of various plans into a unified system. Further research will be performed on the improvement of the economic mechanism, which ensures its orientation toward the intensification of production and the end national economic results.

In the decree it is emphasized, in particular, that under the conditions of the sharp ideological confrontation of the two world social systems the scientific institutions of the Economics Department of the USSR Academy of Sciences and the academies of sciences of the union republics should broaden the critical analysis of the latest bourgeois socioeconomic conceptions, which are aimed against real socialism and against the development and strengthening of the socialist community.

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RESOURCE UTILIZATION AND SUPPLY

IMPORTANCE OF ECONOMIC BALANCES STRESSED

Consumer Ranks High

Moscow MATERIAL'NO-TEKHNICHESKOYE SNABZHENIYE in Russian No 4, Apr 83 pp 23-26

[Article by Doctor of Economic Sciences Professor B. Smekhov (Moscow): "A Balance in the Large and the Small"; passages rendered in all capital letters printed in italics in source]

[Text] The same phenomenon can seem both major and minor depending on with respect to what it is viewed. Insufficient delivery by a plant in the amount of some tenths of a percent with respect to the total amount of the contractual obligations is, of course, a trifle from the point of view of the supplier. But for the client plant this insufficient delivery can turn into a great production disaster.

The improvement of the economic mechanism has the aim, in particular, that the importance of any processes and phenomena in production would be evaluated according to the uniform principle of THE PRIORITY OF THE INTERESTS OF THE CONSUMER. At the level of the sector and the individual economic unit this principle finds expression in the fact that the results of production are evaluated first of all according to the degree of fulfillment of contractual obligations. In practice, however, production time and again experiences serious difficulties due to the insufficient deliveries on time of the necessary means of production, while in the sphere of the sale of consumer items the cases of the lack of correspondence of demand and supply are frequent. The analysis shows that this is attributable to violations of the contractual obligations on not large, but small-tonnage and small-batch orders. Does the supplier suffer from this? No.

Before 1982 enterprises were frequently allowed the nonfulfillment of contracts and orders by up to 5 percent without detriment to the crediting of bonuses. A procedure, in accordance with which the management personnel of associations, enterprises and organizations are deprived of bonuses in full, if the insufficient deliveries exceed 2 percent and only in individual exceptional cases 3 percent, is now in effect. Of course, such a making of the conditions for the payment of bonuses more rigid is essential. Nevertheless the problem is not being solved completely. For insufficient deliveries in any amount are at variance with statewide interests, since they entail the disturbance of the rhythm of social production. And under present conditions this is intolerable.

Undoubtedly the procedure, in case of which the 100-percent fulfillment of contractual obligations will be regarded as the first condition for the crediting of bonuses to the managers of enterprises, will promote the tightening up of the discipline of deliveries. Moreover, this procedure should be applied immediately to all sectors and enterprises. Half-heartedness is intolerable here. The point is that any supplier is at the same time also a consumer. If he as a supplier is under strict conditions, as a consumer he should have guarantees that his suppliers, who work under the same strict conditions, will meet all the obligations to him. Moreover, if the demand of the 100-percent fulfillment of contracts is applied to all economic units, already at the stage of the conclusion of contracts the responsibility for their practicability will increase sharply. Managers will assume only practicable obligations, regardless of whether the consumer needs a large batch of goods or a small amount.

Of course, it is impossible to envisage either in the plan or in the contract economic situations which might arise. What is to be done then, if for unforeseen, truly objective reasons it is not possible to fulfill all the contractual obligations?

First, if the rejection of the maximum percentage of insufficient delivery is applied to all, the described situation will become a rarity. Second, with respect to many types of items special material resources, which are intended for the localization of the consequences of individual violations of the plan of deliveries, can be used. Finally, third, in individual instances, when reasons which, although objective, are external for the enterprise, were the cause of the insufficient deliveries, a strict procedure of the establishment of the guilty parties with the subsequent redistribution of a portion of the revenues of the latter in favor of the given enterprise can be envisaged.

The lack of respect for trifles, which is harmful to the economy, appears not only in deliveries of products. Let us take, for example, the different situation, in which different works find themselves when settling the matter of increasing their production capacities.

It is well known that with respect to some types of products for production engineering purposes the same organ--the USSR State Planning Committee--plans the increase of the production volume, the distribution of products and the necessary increase of capacities. With respect to other types of products the ministries plan production, the USSR State Committee for Material and Technical Supply plans distribution, while the USSR State Planning Committee plans the increase of capacities. They usually explain this by the fact that the latter types of products have a list which is six- to sevenfold larger than the former (about 13,000 descriptions as against 2,000), but with respect to value they have a share in the total amount of produced means of production, which is several times smaller. But for the maintenance of the constant proportionality, balance of the national economy it is extremely important that no trifle would upset the smoothness of production. But this requires such planning of capital construction, so as not to allow disproportions between the production capacities of all works without exception.

It is no secret that with respect to the products, which are distributed by the USSR State Committee for Material and Technical Supply, the problems of expanding production are being solved with great difficulties. And how can it be otherwise,

if the substantiation of the need for the increase of capacities for these products is carried out by the workers of the USSR State Committee for Material and Technical Supply, while the inclusion of this increase of capacities in the plan of capital construction does not depend on them. In these cases the ministries maintain a kind of "neutrality": if, they say, in the USSR State Planning Committee they allocate capital investments for these trifles, we will increase the capacities and, accordingly, the production plan. Otherwise a shortage is inevitable.

The allocation of capital investments for the increase of output can give some assistance for the assurance of an equal situation with the increase of the capacities of the production of all types of items of intersectorial use. The point is that in this case the entire increase of output is taken, regardless of what part of it is assigned to what products list of the plan of distribution.

However, in case of the distribution of capital investments among individual projects (the title lists of capital construction) the problem of trifles arises without fail. A blast furnace, a block of an electric power station, a plant for the production of mineral fertilizers are one thing. And a small plant for the specialized production, say, of hardware is a completely different thing. With respect to both the scale of construction and the value of its products this is a trivial thing. The attitude toward such a plant as a trivial thing is also strengthened by the fact that, for example, everyone can produce hardware. Here, however, they close their eyes to the fact that the nonspecialized production of hardware entails enormous losses of metal and labor, while the quality of items is poor. The cost, for example, of primitively produced fasteners on general-purpose machine tools is several times greater than that of those produced on automatic cold headers.

For the proper evaluation of the importance of one economic phenomenon or another, of course, it is necessary to take into account not only individual facts, which characterize this phenomenon, but also the scale of their prevalence. In the case with hardware the isolated fact of their primitive production at an individual plant would indeed be a trivial thing. But the same fact, which has been multiplied by tens of thousands of enterprises, which are forced to produce bolts and nuts by themselves, becomes an obstacle in the matter of the intensification of production.

The difficulties in the supply of "trifles"--products which take up a small share in social production--are by no means isolated phenomena. Meanwhile a strain in the balance of any product, especially those for multisectorial use, threatens the smoothness of all social production. In these cases it is easy for those to blame for the violation of planning discipline to take refuge in the difficulties of supply.

A comprehensive approach is necessary not only in the planning of the production and distribution of products. The requirement of the balance of economic phenomena, which are different in importance, also applies, for example, to the coordination of the plans for different periods. In practice on account of current matters they frequently forget the future and, on the contrary, having been carried away by the large scale of the long-range plan, they ignore urgent current tasks.

It is well known how highly V. I. Lenin rated the long-range plan of the State Commission for the Electrification of Russia, calling it the second program of the

party. At the same time he cautioned against one-sided enthusiasm for the long-range plan. Having in mind the plan of the State Commission for the Electrification of Russia, V. I. Lenin wrote: "When I have in front of me the people who WROTE this book, I would stick their NOSE not into this book, but AWAY FROM IT-- into the questions of current economic plans." And further there follow specific instructions on the breakdown of forces in the State Planning Committee: "1-2 sub-commissions for electrification. 9-8 subcommissions for current economic plans."¹

It should be emphasized that there are no trivial things for the balance of the national economy, while in a number of cases it is necessary to take into account the degree of importance of various processes and phenomena.

In the decree of the CPSU Central Committee and the USSR Council of Ministers on the improvement of the economic mechanism the terms "important," "most important" and "especially important" types of products are used repeatedly. But these terms apply to those peculiarities of the use value of products, which make them decisive in technical progress. In the decree it is emphasized that "the proper determination of the priorities in the development of sectors and economic regions for the assurance of progressive changes in the national economic proportions, the increase of the effectiveness of capital investments and all social reproduction" is necessary. At the same time it is indicated that the USSR State Planning Committee, the USSR State Committee for Material and Technical Supply, the USSR ministries and departments and the councils of ministers of the union republics "...bear responsibility for the balance of the plans with material resources, the approval of the balances and plans of distribution with respect to which is assigned to these organs."

Thus, the balance of the plans should be ensured with respect to all types of most important and not most important types of products. This applies not only to the plan of the development of the entire national economic complex, but also to individual mutlisectorial programs. For example, the successful implementation of the Food Program presumes the coordinated development of all the sectors and individual units of the agro-industrial complex. Referring to the fundamental directions of the development of the agro-industrial complex, General Secretary of the CPSU Central Committee Comrade Yu. V. Andropov at the November (1982) CPSU Central Committee Plenum stressed that "...it is a matter precisely of a complex in which there are no secondary tasks."

The need to single out the leading sections, to which the greatest development must be given in conformity with the main economic and political task of the given period, arises everything when determining the plans of the development of the national economy for one period or another. Lenin's principle of the basic units implies the concentration of resources and efforts on these sections of the building of communism. At the same time the fulfillment by the basic units of the role, which they are called upon to play, depends on the degree of balance of the plans. The change of the structure of the national economy in favor of the most important types of works is effective only if a complete balance within the unified national economic complex is observed.

The requirement of a complete balance ensues from the very essence of the unity of the national economic complex. It is impossible to ensure a balance only with

1. V. I. Lenin, "Poln. sobr. soch." [Complete Works], Vol 52, pp 128-129.

respect to a portion of the products, even the most important products. If with respect to the remainder the resources do not conform to the need, this leads without fail to disproportions at the meeting point between the production of the most important and other products. Hence, in particular, the problem of coordinating the balances of the products, which are distributed by various organs, also arises.

The requirement of a complete balance, furthermore, implies the need for the assurance of conformity between the assets being allocated in accordance with the consolidated products list and its specification at the stage of the concluding of contracts. Obviously, time is necessary for such coordination. But, as a rule, there was not enough of it. That is why it is important that the USSR State Planning Committee moved the start of the compiling of the 1983 plan to an earlier date. This is an important step in the direction of the increase of the degree of the real balance of the national economy.

The problem of the division of the sectors of the national economy by degree of importance must also be examined on the territorial level. The specialization of production in the economic regions and union republics is necessary from the point of view of the all-union division of labor. The sectors, in which a region specializes, take up a large share and receive priority in development. Frequently, however, the other sectors, especially the sectors of the infrastructure, including material and technical supply, lag in their development behind the needs of the region. The reason here is the same as in all other instances when the division into important and less important is used without reason.

Of course, the limitedness of resources has the result that the sectors of all-union importance can be developed in the region more rapidly. But the development, so to speak, of nonpriority sectors at a relatively slower pace is just as important for the balance of the economy as the development of priority sectors with their fast rate. Moreover, the very development of the priority sectors of a region in many ways depends on the use of local construction materials, the efficient use of manpower resources and the all-round development of the sectors of the production and social infrastructure.

Another aspect of the problem of "trifles" in the economy is the problem of the prevention and elimination of losses. The lag in the construction of storehouses, warehouses and roads to a considerable extent springs from "the inertia of thinking" and the attitude toward all this as something secondary.

Let us take for an example the production of containers, which usually cannot lay claim to priority. And, indeed, containers are not of independent importance for technical progress or the meeting of the needs of the population. From the point of view of that balance of the national economy, which ensures the maximum possible preservation of the created values in the process of transportation, the lag in the production of containers is equivalent to the decrease of the rate of production as compared with the possible rate. Nearly one-fifth of the mineral fertilizers are lost due to the imperfection of packaging services. Moreover, 45.6 percent of the containers are made from scarce lumber, the rate of development of the production of cardboard and polymeric containers is low. The implementation of the Food Program requires the drastic improvement of packaging services.

In many instances the capacities of some shops, which have been newly put into operation, for a long time cannot be assimilated due to the lag of others. The reason lies in the fact that even in case of the construction of a separate enterprise the attitude toward its different units is not identical. Thus, at the Yermak Ferroalloy Plant they increased the capacity of the furnaces rapidly, but the shop for the preparation and transportation of the burden was of low capacity. As a result at the beginning of last year the capacities of the furnaces were used at the level of only 41 percent, many metallurgical enterprises did not receive ferroalloys from the plant.

The improper attitude toward "trifles" assumes the most diverse forms. For example, it is entirely understandable when relatively more workers are attracted to a sector which is developing more rapidly. But why should these workers have advantages in wages as compared with the workers of other sectors under identical working conditions? In reality this occurs. Frequently sectors are divided into important and less important according to the level of wages for the same work.

Here is one example: the communications sector is experiencing great difficulties in attracting workers. Meanwhile, so far rewards for seniority have not been introduced in this sector. However, from the national economic point of view the turnover of personnel at the post office is just as harmful as in any other sector.

Apparently, the time has come to change drastically the attitude toward trifles. If they influence the balance of economic development, one must not treat them disdainfully as something unimportant only because they are of supplementary importance.

Since the problem of trifles in many instances also arises in various aspects, it is not out of place to attempt to determine the criterion of the ranking of products and economic phenomena according to the degree of importance. In our opinion, the very raising of the question of such a criterion can apply only to those instances when it is necessary to determine the priorities in the development of sectors, regions and various subdivisions within enterprises. This is connected first of all with the distribution of capital investments, the allocation of resources and so forth. Here the criterion for assigning some parts of the complex to the more important and others to the less important can be defined in the following manner: the dependence of the achievement of the goal or the accomplishment of the task in the economic development of the given complex on the growth rate of its individual parts. When it is a question of the balance of the economy at any level, the ranking of the units of the unified complex by degree of importance only does harm. Moreover, it is necessary to establish the ratio of the growth rates of different sectors, regions and so on according to the principle of a complete balance at the highest level of economic efficiency.

One must not arrange sectors forever according to the order of their importance. An economical balance during a given period may require substantial changes in the formed growth rate of sectors. If, for example, for the preservation of products it is required to accelerate the development of the production of containers, it is not ruled out that at this stage this production may be among the priority ones.

For the intensification and the increase of the efficiency of social production it is necessary to increase the degree of balance. This is a complicated task. One

of its components is the universal observance of the necessary proportions not only in what is large, but also in what is small. "Trifles" are too expensive when they are ignored.

The need has arisen to take realistic steps in the direction of increasing the degree of balance of the production and distribution of all types of products for production engineering purposes, without breaking them down by degree of importance. In particular, the examination of the problems touched upon above, in our opinion, makes it possible to draw several practical conclusions.

It is time to reject the use of the maximum percentage of the nonfulfillment of contractual obligations on deliveries and to change over to a system of the payment of bonuses only in case of the 100-percent observance of contractual discipline with respect to any large or small orders of consumers.

When drafting the plan for the 12th Five-Year Plan it is necessary to ensure the coordination of the long-range plans of supply with the balances of the corresponding production capacities and title lists of capital construction with respect to all types of products, which are distributed both by the USSR State Planning Committee and by the USSR State Committee for Material and Technical Supply and the ministries. Without such coordination a lag of the production of "secondary" types of products behind the growth of public needs is inevitable. Moreover, the broadening of the standardized base, especially with respect to those products, regardless of their importance, in accordance with which the long-range balances are formed with a great effort, is required.

It is necessary to plan the development and location of the network of enterprises for deliveries of products for production engineering purposes as an integral component of the program of the formation of territorial production complexes.

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Industry-Demand Tradeoffs

Moscow MATERIAL'NO-TEKHNICHESKOYE SNABZHENIYE in Russian No 7, Jul 83 pp 25-28

[Article by Yu. Lapchenko, deputy chief of a division of the Ukrainian SSR State Planning Committee; T. Prihod'ko, chief of a sector of the Ukrainian Affiliate of the Scientific Research Institute of Planning and Norms attached to the USSR State Planning Committee; and senior scientific associate D. Povod (Kiev): "Improve the Balance of Production and Consumption"]

[Text] In conformity with the decree of the CPSU Central Committee and the USSR Council of Ministers on the tightening up of the discipline of deliveries the USSR State Planning Committee and the USSR State Committee for Material and Technical Supply should take additional steps on the improvement of planning, the improvement of the balance of the production volumes with material and technical resources and the timely elimination of the shortcomings in the development of sectors, which come to light during the fulfillment of the plan.

For the purpose of implementing the indicated decree the Ukrainian SSR State Planning Committee is planning the implementation of a number of measures, including

the increase of the number of material balances being elaborated. For example, the elaboration of balances for 17 types of fuel and energy resources, 13 types of material resources, 11 types of agricultural products and so on is envisaged for the annual and five-year plans.

It should be noted here that the balances being elaborated still have serious shortcomings and require further improvement. First, the lines of the resource part of the balance "imports" and the distribution part "exports" are determined either according to the established relative level or according to the plan drafts. They can also be filled in according to the totals of the calculations: in case of a shortage--in the line "imports", in case of a surplus--"exports." These lines can be made more precise only in case of the elaboration of the material balances in the USSR State Planning Committee. Second, the standards, on the basis of which the balances for the five-year plan and the more distant future are drawn up, are elaborated on the basis of the reporting data for past years with the corresponding adjustment, which takes into account advanced measures on the efficient and economical use of material resources. Here the effect of scientific and technical progress, which significantly influences both the progressiveness of the rates of consumption and the range of materials, which is being produced, is not taken into account. The replacement of old materials with new, advanced and more efficient ones is also not taken into account.

In our republic the material balances are drawn up in accordance with the list of products, which are planned by the Ukrainian SSR State Planning Committee, by economic regions of the republic and with a breakdown by oblasts. For example, 11 material balances are elaborated for construction materials. The problems of the coordination of the plans of the production and distribution of products with an oblast and intersectorial breakdown, the distribution of productive forces on the territory of the republic, interregional transportation and economic ties and the making of products from local raw materials, production scraps and so forth are solved in the process of elaborating these balances.

Executive material balances are elaborated by the Ukrainian SSR State Committee for Material and Technical Supply and its main territorial administrations in accordance with the products list of the statewide system of material and technical supply. The elaboration of these balances is carried out on the basis of the executive balances, which are submitted by the consuming enterprises (organizations). The products list, in accordance with which the executive material balances are elaborated, include about 300 line items. The executive material balances are elaborated for the purpose of the analysis of the fulfillment of the plan of material and technical supply in accordance with the directions of consumption, as well as for their use when compiling the balances and plans of the distribution of material resources for the next planning period.

However, the use in planning work of single-product material balances does not solve completely the problem of the balance between the production and consumption of resources. Thus, in case of the elaboration of single-product material balances only the direct dependences between the technologically connected works are taken into account and the indirect relations are not taken into account, and therefore the economic interrelations in the process of the production and consumption of products are not reflected completely enough.

The analysis of the plan of material and technical supply for republic and nonindustrial union republic ministries and departments, which was made on the basis of the calculations of the interproduct balance by types of material resources, in accordance with which the single-product balances are elaborated, showed that a complete balance of the volumes of production and consumption was not achieved. It was proposed to eliminate the discrepancies between the resources and the need for them of the national economy, which arose in the plan, by the identification of additional reserves.

The unbalance of the production and consumption of material resources leads to such undesirable phenomena as a constantly arising shortage with respect to individual types of products, irregularities of the volumes and dates of deliveries in accordance with contractual obligations, the decrease of the quality of the output being produced, the dragging out of the period of construction of new projects and their turning over for operation with specific flaws in workmanship.

During the fulfillment of the plan of material and technical supply elements of the unbalance of the production and consumption of individual types of material resources are aggravated. Thus, the assets for material resources are attached to suppliers not in the full amount and with significant deviations from the ordered specifications, the quarterly breakdown of the assets is carried out irregularly, the deliveries of products by industrial enterprises, as well as the enterprises of the USSR State Committee for Material and Technical Supply are disrupted, consumers are attached to unreal suppliers, contractual obligations are not fulfilled, numerous changes (the decrease) of the allocated assets occur.

The increase of the level of the balance of the planned volumes of the production and distribution of material resources can be achieved by the compilation of interproduct balances, which are based on the use of mathematical economic methods and computer facilities. The elaboration of such balances ensures a systems analysis and the simultaneous calculation of the entire set of single-product balances, which are being elaborated, increases the variance and accuracy of the planning calculations and orients all planning work toward the end results of production. Consequently, this is an important stage in the improvement of the planning of material and technical supply.

The interproduct balances as a new, more perfect tool of planning calculations can find extensive use in the work of the state planning committees and the state committees for material and technical supply.

On the orders of the USSR State Planning Committee the Ukrainian Affiliate of the Scientific Research Institute of Planning and Norms jointly with the Institute of Cybernetics of the Ukrainian SSR Academy of Sciences conducted studies and made calculations of the interproduct balance for republic and nonindustrial union republic ministries and departments. These studies were conducted for the purpose of developing the procedural bases of the construction of interproduct balances.

The economic scheme and the mathematical model of the interproduct balance of the union republic are a further development of the well-known schemes of the intersectoral balance on the basis of the more complete consideration of the peculiarities of the existing practice of drafting the plans of material and technical supply.

The task of calculating the interproduct balance of the union republic for the drawing up of the draft of the annual plan is formulated in the following manner. Given the desired amount of final consumption and the desired coefficients of direct expenditures it is necessary to determine for the material resources, which are produced in the republic and nonindustrial union republic ministries and departments, the mutually balanced volumes of consumption, which ensure the meeting of the total consumption in production and final consumption. With respect to imported types of material resources it is necessary to calculate in case of the same original data the need for the assurance of both the desired volumes of the output of products of the sectors of union and union republic subordination and the planned volumes of the output of products of industry of republic subordination. It is necessary to verify the backing of this need with the planned amount of centrally allocated assets by the calculation of the indicators of disbalance.

The essence of the task consists in the determination of those volumes of the production of material resources being produced in our republic, which ensure equality between the resource and distribution parts of the interproduct balance. These production volumes are, on the one hand, a component of the resource part and, on the other, an element which forms the production need in the distribution part of the interproduct balance. The basic conditions of the accomplishment of the task are the observance of equality between the material resources, which have been obtained by means of the planned volumes of internal republic production, imports from other republics in accordance with the centralized funds, other sources of receipt and the actual balances at the beginning of the year being planned, and the resources, which are distributed for the production of industrial products and are defined as the product of the coefficient of direct expenditures times the planned production volume, other consumption in production and final consumption, as well as the resources, which are supplied in accordance with the plan of inter-republic deliveries (exports) and for the provision of carryovers. In case of the failure to observe this condition a positive or negative disbalance will be obtained, which it is necessary to eliminate by the change of the planned volumes of production, imports, exports or the placement into operation of new production capacities.

A products list of the interproduct balance, which encompassed 280 types of products of 25 sectors of industry, was drawn up for the purpose of making calculations at the level of the Ukrainian SSR State Planning Committee. In all 120 descriptions, in accordance with which in the Ukrainian SSR State Planning Committee the calculations of the need are made and the plans of distribution are drawn up, were included in the so-called line products list of the interproduct balance. Among them are the products of ferrous and nonferrous metallurgy, the chemical and petrochemical, timber and pulp and paper, the wood processing and construction materials industries, electric power, as well as the products of light and the food industries. In all 178 types of products, which are planned by the USSR State Planning Committee, were included in the so-called column products list of the interproduct balance. Raw materials and materials, which make up the line products list of the balance, are used for their production.

When constructing the articulation part of the interproduct balance it is necessary to ensure the identity of the lines and columns according to the description, the content and the units of measurement of the products. For this the complete conformity of the products lists of the calculations of the need and the plans of

distribution and production should be achieved. For example, in the USSR State Planning Committee with respect to shock-resistant polystyrene a separate calculation of the need is made, while the centralized funds in conformity with the plans of distribution are singled out within the general line item "Polystyrene and Copolymers of Styrene."

A characteristic distinction of the products list of the calculations of the need and the plans of production is the different degree of aggregation. One grouped line item includes several subgroup line items of the products list of the calculations of the need. For the assurance of the necessary conformity the grouped line items of the plan of production are subdivided into subgroup and specific items in conformity with the products list of the calculations of the need. This makes it possible to implement the principle of bringing the line products list of the interproduct balance as close as possible to the products list, in accordance with which the calculations of the need are made and the plans of distribution within the national economic plan of the republic are drafted.

The incomparability of the products lists in the forms of planning documents is among the shortcomings of the existing practice of planning. These shortcomings appear especially vividly when constructing the interproduct balance. Their elimination even in case of the existing methods of planning calculations will increase the consistency and interconnection of the indicators of various sections of the plan, as well as will make it possible to speed up the introduction of the interproduct balance in the practice of planning.

An important question of the information support of the calculations of the interproduct balance is the formation of the coefficients of the direct material expenditures on the product-consumer. In their economic content the coefficients of the direct material expenditures are close to the technological rates of consumption of resources, which are used in the practice of planning. In this connection the weighted average grouped rates of consumption of raw materials and materials, which are represented in the calculations of the need for material resources, conform to the greatest extent to the formed products list of the interproduct balance. These calculations were made by the Ukrainian SSR State Planning Committee in the process of drawing up the plan of material and technical supply.

The rates of consumption of material resources, which are contained in the calculations of the need, were formulated with allowance made for the specific nature of production and consumption by sectors. They are the planned sectorial standards of the consumption of raw materials, materials, fuel and electric power, which are used directly in the production of products in the republic and conform for the most part to the level of development of equipment, the technology and organization of production, and therefore can be used for the calculations of the interproduct balance.

The determination of the need for material resources for final consumption is an important stage in the preparation of the initial information for the calculations of the interproduct balance. The material resources, which are allocated for the needs of current nonproduction consumption (personal and public) and capital construction, construction and repair in accordance with the orders of the population, for the increase of working capital, reserve commodity stocks and reserves, as well as for other consumption, which includes special expenditures and operations and planned losses, are included in the final consumption.

The amount of material resources, which go into nonproduction consumption, is reflected in the indicator "the marketable stock," which characterizes the deliveries of individual types of goods to retail trade from state resources. The deliveries of goods for the sale of consumer items and means of production for small-scale wholesale sales to institutions and organizations and for the creation of the necessary stocks in retail trade are included among the marketable stocks. The need for material resources for the backing of capital investments is determined on the basis of the data on the amount of construction and installation work and the consolidated rates of consumption per million rubles of this work.

One of the important components of the final product is the increase of working capital, stocks and reserves. The material resources, which are used for the increase of the stocks of raw materials, materials, fuel and finished products, as well as state material resources, are included here. The increase of stocks in retail trade and on the private plot of the population are not included in the final product in accordance with the item of stocks, since they are included in the marketable stocks.

Elementary calculations of the interproduct balance for republic and nonindustrial union republic ministries and departments were made for the purpose of determining the level of balance of resources and the need in the draft of the annual plan of material and technical supply of the republic. These calculations were made in the Unified System of Electronic Computers with the use of a program package of the solution of the steady-state problem of the intersectorial balance within the framework of the dialogue system of the operational balancing of resources (the displan), which was developed by the Institute of Cybernetics of the Ukrainian SSR Academy of Sciences. The analysis showed that a complete balance of resources and the need in the draft of the plan of material and technical supply of the republic during the year being calculated was ensured for 87.5 percent of the descriptions of material resources, which were included in the calculation. For the remaining types of resources such a balance was not achieved. The exceeding of the need with respect to the order documents, on the other hand, and the consideration in the process of calculating the interproduct balance of both the direct and the indirect expenditures, on the other, were the reason for this.

The economic analysis of the results of the calculation of the interproduct balance made it possible to give a description of the production interrelations in the national economy of the Ukrainian SSR with respect to the products, which are planned and distributed by the USSR State Planning Committee, and to establish the absolute amounts and structural changes of the material flows. Such physical flows as the production of rolled ferrous metal products, as well as the products of the chemical and petrochemical industry are singled out by absolute amounts among the material resources which are included in the products list of this balance. Rolled ferrous metal products, cold-drawn sectional steel, roll-formed steel sections, synthetic resins and plastics, sulfuric acid, nitrogen fertilizers, offset, wrapping and packaging paper, plywood, wire nails, wire of ordinary quality and so on are characterized by the greatest rate of consumption. Truck trailers, cargo trolley-buses, truck-mounted mobile workshops, elevators and so on are the main products, for the production of which the largest number of types of material resources are used.

The analysis also showed that the use in the process of drafting the plan of material and technical supply of the republic of the system of calculations of the interproduct balance, which are combined with the direct calculations of the need, makes it possible to achieve the greatest degree of coordination of the amounts of material resources, which are produced in the republic and are imported in accordance with the plans of interrepublic deliveries, as well as the more valid determination of the level of balance with respect to all the types of products, which are included in the calculation.

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ECONOMIC MODELING AND COMPUTER TECHNOLOGY APPLICATION

BALANCE METHOD FOR MODELING NATIONAL ECONOMIC TIES

Moscow VESTNIK STATISTIKI in Russian No 7, Jul 83 pp 44-49

[Article by M. Melikhov, candidate of economic science, acting docent, Tula branch of the All-Union Financial-Economic Correspondence Institute (VZFEI): "Balance Method for Modeling National Economic Ties in the Nonproduction-Oriented Area"]

[Text] The nonproduction-oriented areas takes up an increasingly larger share in the country's economy, using a considerably larger part of the national income for its functioning and development. As this part grows, the role of the nonproduction-oriented area is becoming more noticeable in forming the proportions of the final distribution of the national income and, consequently, in balancing the process of national reproduction.

Under these conditions, the planning and management departments must set up a special analytical instrument that would make it possible to penetrate deeper into the mechanics of the national economic ties in the nonproduction-oriented area, which would secure the formation of its final income. Balancing the national economy is that type of instrument at the present time. However, its analytic capabilities must be broadened for comprehensive analysis of the economics of the nonproduction-oriented area, which is one of the urgent tasks of statistics.

This task may be dealt with by developing an integrated balance system which would reflect the whole complex of the interconnected aspects of the functioning of the nonproduction-oriented area in the machinery of the socialist economy. The existing scheme of balancing the national economy is the basis for constructing such a system. Keeping in mind, however, that the indicators of the nonproduction-oriented area are in different parts of the balance, a preliminary systematical coordination of the individual tables is necessary, with the goal of subsequently transforming them into an integrated balance system. Such a transformation is carried out by interpreting economic turnover as a whole complex of basic economic operations.

An elementary economic operation is described in the form of the directional diagram depicted in Figure 1 (the curves are drawn toward A^1).

The peaks of the diagram are the economic subjects A_i and A_j . The curves of the diagram, a_1, a_2, \dots, a_n , represent the units of value, which for subject A_j represent expenditure and for subject A_i represent income. The edges of the diagram, a_1, a_2, \dots, a_n , can be replaced by one edge γ , which is multiple to the sum of the corresponding transfer. Based on this, each elementary economic operation is represented as indicator a_{ij} , with an addressing character.

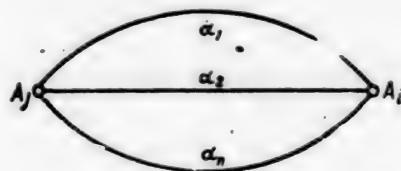


Figure 1. Diagram of an elementary economic operation

With such a representation of elementary economic operations, different classifications are used as indices i and j . The process of national reproduction, as a whole or in its individual aspects, is based on these indices.

Because of the closed character of economic turnover, the description of the entire sum total of the executed elementary economic operations is a directed Eulerian diagram, in each peak of which the total multiplicity of incoming curves equals the total multiplicity of the outgoing curves.

This diagram is not complete, because not all economic subjects are directly connected with each other, but it always has a way of connecting either of the two peaks; this makes it possible to analyze all the operations undertaken in a single coherent system.

A formal description of economic turnover in the form of a Eulerian diagram leads to the construction of an integrated balance system in which each peak is a calculation, while each representation of the calculation represents the linkage connecting a given peak with another, in whose calculation it is also represented. In this, in the calculation of one peak, a given linkage is marked as expenditure and in the calculation of another as income. Based on this, each peak of the diagram with incoming and outgoing curves represents an elementary balance.

The representation of linkages between previously determined peaks that includes the entire number of elementary economic operations being performed results in a thorough systems description of economic turnover. The application of the given formal method describes the principal feature of the methodology for constructing an integrated balance.

Such a balance may be shown in graph-form, a system of balance equations, a system of balance calculations, or in the form of a square matrix. The selection of a concrete form is determined on the basis of practical

considerations, depending on the task of the analysis, the extent of enlargement of the figures, and also the scale of the balance construction.

The best form of an integrated balance is a square matrix in which each identical line and column form a balance. In it, the individual elements of the matrix reflect the correspondence of different balances, which in conjunction form a balance system. This makes it possible to represent each transfer of the expenditure one time, but to receive it twice: one time along the line as income and another time along the column as expenditure.

A matrix depiction of the balance system makes it possible to describe the connections between quite a large number of balances; in it, the system may be multistaged or in the form of a series of matrices with different degrees of aggregations of indices, or in the form of interlocking matrices. The material balance converted into matrix form is shown in Figure 2.

Along column one, the given balance matrices reflect the production of different groups of products by industries of the production area within the country ($Q_{2.1}^m$) and the corresponding import of products ($I_{5.1}^m$). For this reason, the total R_1^m along column one reflects the total volume of the combined national product.

The distribution of the combined national product is reflected along column two. Part of it represents physical input ($C_{1.2}^m$); the remainder represents consumption ($F_{3.2}^m$) and savings ($H_{4.2}^m$).

For this reason, balance parity is maintained along column and line two:
 $Q_{2.1}^m = C_{1.2}^m + F_{3.2}^m + H_{4.2}^m$.

From this, equality of $D_2^m = R_2^m$ occurs. In this, consumption and savings, ($F_{1.2}^m$ and $H_{1.4}^m$), reflected for the industry section along column two, are shown simultaneously at the intersections of columns 3 and 4 with line 1, according to product groups ($F_{1.3}^m$ and $H_{1.4}^m$). The export of corresponding products ($E_{1.5}^m$) is shown in the same place along line one at the intersection with column five.

Thus, the sums of all elements of identical lines and columns of the balance prove to be equal to each other.

			1	2	3	4	5	6	
(1)	(2)								
Баланс производства, потребления и накопления общественного продукта	Производство СОП	(3) Группы продуктов	1		$C_{1,2}^m$	$F_{1,3}^m$	$H_{1,4}^m$	$E_{1,5}^m$	D_1^m
		(4) Отрасли производственной сферы	2	$Q_{2,1}^m$					D_2^m
	(5) Потребление	3		$F_{3,2}^m$				D_3^m	
	(6) Накопление	4		$H_{4,2}^m$				D_4^m	
	(7) Внешние связи (импорт, экспорт)	5	$I_{5,1}^m$					D_5^m	
	(8)	Итого	6	R_1^m	R_2^m	R_3^m	R_4^m	R_5^m	

Figure 2. Aggregated material balance in matrix form

- KEY: (1) Balance of production, consumption, and savings of the national product
 (2) Production of the combined national product
 (3) Groups of products
 (4) Industries of production area
 (5) Consumption
 (6) Savings
 (7) Foreign ties (import, export)
 (8) Total

From the given construction, it can be seen that the matrix of the material balance formally describes the process of production, consumption, and savings of the combined national product in the closed cycle of economic turnover.

The next phase of integrating the balance indicators of the national economy is transforming the overall financial balance into a matrix form. The aggregated financial balance in matrix form is presented in Figure 3.

			1	2	3	4	5	6	7	8
(1) Баланс производства, распределения и перераспределения общественного продукта и национального дохода	(2) Производство СОП	1	$C'_{1.1}$					$F'_{1.6}$	$H'_{1.7}$	D'_1
	(3) Доходы и расходы производственной сферы (4)	2	$P'_{2.1}$				$P'_{2.5}$			D'_2
	Доходы и расходы непроизводственной сферы (5)	3					$P'_{3.5}$			D'_3
	Доходы и расходы населения (6)	4	$Z'_{4.1}$				$P'_{4.5}$			D'_4
	Перераспределительные платежи (7)	5		$T'_{5.2}$	$T'_{5.3}$	$T'_{5.4}$				D'_5
	(8) Потребление	6			$F'_{6.3}$	$F'_{6.4}$				D'_6
	(9) Накопление	7		$H'_{7.2}$	$H'_{7.3}$	$H'_{7.4}$				D'_7
	(10) Итого	8	R'_1	R'_2	R'_3	R'_4	R'_5	R'_6	R'_7	

Figure 3. Aggregated financial balance in a matrix form

- KEY: (1) Balance of production, distribution, and redistribution of the national product and national income
 (2) Production of combined national product
 (3) Distribution and redistribution of national income
 (4) Income and expenditure in production-oriented area
 (5) Income and expenditure in nonproduction-oriented area
 (6) Personal income and expenditure
 (7) Redistributing payments
 (8) Consumption
 (9) Savings
 (10) Total

- $C'_{1.1}$ Reimbursement of Material production costs
 $P'_{2.1}$ Primary income of enterprises of the production-oriented area
 $Z'_{4.1}$ Wages of workers in production-oriented area
 $P'_{2.5}$ Derived income of production-oriented area
 $P'_{3.5}$ Derived income of nonproduction-oriented area
 $P'_{4.5}$ Derived personal income

- $T_{5.2}^f$ Redistributed payments of production-oriented area
- $T_{5.3}^f$ Redistributed payments of nonproduction-oriented area
- $T_{5.4}^f$ Redistributed personal payments
- $F_{6.3}^f$ Consumption of nonproduction-oriented area
- $F_{6.4}^f$ Personal consumption
- $F_{7.2}^f$ Savings in production-oriented area
- $H_{7.3}^f$ Savings in non production-oriented area
- $H_{7.4}^f$ Personal savings
- $H_{1.6}^f$ Total consumption fund in the national income
- $H_{1.7}^f$ Total savings fund in the national income

An analysis of the material and financial balance matrices gives grounds for making the following conclusions:

a) The financial balance, as with the material balance, describes the distribution process of the national product:

$$(C_{1.1}^f = C_{1.2}^m, F_{1.6}^f = F_{1.3}^m, H_{1.7}^f = H_{4.4}^m);$$

b) The financial balance, just as the material balance, describes the savings and consumption processes. The given indicators have a functional tie with each other:

$$(F_{3.2}^m = F_{6.3}^f + F_{6.4}^f); (H_{4.2}^m = H_{7.2}^f + H_{7.3}^f + H_{7.4}^f);$$

c) In addition to the material balance, the financial balance describes the following processes: formation of primary income ($P_{2.1}^f$ and $Z_{4.1}^f$) and redistribution of income ($T_{5.2}^f$, $T_{5.3}^f$, $T_{5.4}^f$, $P_{2.5}^f$, $P_{3.5}^f$ and $P_{4.5}^f$). These processes apparently are also the basic area of its study as "financial" balance;

d) In addition to the financial, the material balance reflects the import and export ($I_{5.1}^m$ and $E_{1.5}^m$) product;

e) The financial and material aspects of the two matrices are found in the following balance tie:

$$P_{2.5}^f + P_{3.5}^f + P_{4.5}^f - T_{5.2}^f = T_{5.3}^f - T_{5.4}^f = P_{2.1}^f + Z_{4.1}^f = O_{2.1}^m - C_{1.2}^m + E_{1.5}^m = F_{3.2}^m + H_{4.2}^m.$$

It should be noted that the financial balance is combinable with the interindustry balance matrices, because $C_{1.1}^f$ is information on quadrant one of the interindustry balance in aggregated form, while $F_{1.6}^f$, $H_{1.7}^f$ and $P_{2.1}^f$, $Z_{4.1}^f$ are information on its quadrants two and three.

On the basis of the information set forth above, it is proper to raise the question regarding the joining of the basic national economic balance tables (that describe the national reproduction process) by coordinating them at right angles; as a result, an integrated system of state economic ties is obtained (Figure 4).

		<i>m</i>	<i>f</i>	<i>p</i>	<i>n</i>	<i>s</i>
(1) Материальный баланс	<i>m</i>	S^{mm}		S^{mp}	S^{mn}	S^{ms}
(2) Финансовый баланс	<i>f</i>	S^{fm}	S^{ff}			S^{fs}
(3) Баланс потребления	<i>p</i>		S^{pf}			
(4) Баланс накопления	<i>n</i>		S^{nf}			
(5) Баланс внешнеэкономических связей	<i>s</i>	S^{sm}	S^{sf}			

Figure 4. Integrated system of national economic balances

- KEY: (1) Material balance
 (2) Financial balance
 (3) Consumption balance
 (4) Savings balance
 (5) Balance of foreign economic ties

The given system is formed by five interrelated balances: material, financial, consumption, savings, and foreign economic ties. Each of the balances in such a system describes one of the aspects of the economic turnover of material and financial resources in its interrelation with other aspects.

The material balance describes the reproduction process connected with the creation and distribution of the national product. Thus, for example, depending on the classification selected and the extent of aggregation, block S^{mm} may reflect either the total fund of physical production input of the interindustry production ties in much the same way as quadrant one of the interindustry balance. Block S^{fm} may reflect either the newly created value of the elements of net output, as in quadrant three of the interindustry

balance, or the various types of income in the industries and sectors of the national economy. Block S^{ff} reflects the redistribution process of the production income, as a result of which the final income of the national reproduction participants financing the formation of consumption and savings funds is formed. For this reason, the consumption and savings funds are a connecting link (joining) between the material and financial balances. Depending on the goals of the economic-statistical analysis and the classification used in the block, S^{ff} may reflect the industrial consumption structure from various incomes, and block S^{mp} may reflect the forms of savings on an industrial level or sources of financial saving. Block S^{mn} may be the reflection of the material saving structure in various forms.

The balance of foreign economic ties is placed in the integrated system as an independent instrument of the economic-statistical analysis of the material and financial ties of the national economy with foreign countries.

From the information set forth above, it is obvious that deaggregation of blocks of the model of the integrated balance system takes place in accordance with the chosen direction of the statistical analysis of the economic turnover. Here the degree of specification of the indicators is determined by the specific tasks of planning and management of different economic sections of the national economy. The limitations in this case may be only the information incompatibility of the indices with the calculating system in use and also the absence of the necessary intersections in the statistical classification being used regarding economic elements. However, in each specific case, the given limitations at hand may be overcome by systematic improvement of the calculating system and the classifications in use.

Deaggregation of the indices of the balance system under review, which originated from the tasks of the economic-statistical analysis of the national economic ties of the nonproduction-oriented area, is illustrated by the graph shown in Figure 5. As the scheme shows, each balance forming the integrated model is deaggregated in such a way that the system of statistical indices of the economy of the nonproduction-oriented area fits naturally into the closed system of indices of the balance of the national economy.

In summary, the balance of the national economic ties of the nonproduction-oriented area fits naturally into an integrated system of the national economic balances. This makes it possible to analyze the economic indicators of the nonproduction-oriented area in a single system of material goods and value proportions of national reproduction. Such an analysis makes it possible, on one hand, to observe how any kind of change of the given proportions influences the economy of the nonproduction-oriented area and, on the other hand, how this or that change in the economics of the nonproduction-oriented area influences the given proportions. Depending on the chosen direction of the analysis, the integrated system of national economic balances may be deaggregated in such a way that the different aspects of the economics of the nonproduction-oriented area are reflected from the positions of a separate economic industry, a group of industries, or the national economy as a whole. At the same time, the systematic specification of indices of the balance system makes it possible to describe the internal economic turnover of the nonproduction-oriented area, in the process of which its final income is made.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
(1) Материальный баланс	(3) Доходы и расходы производственной сферы	1	C ₁₁																			
	(4) Доходы и расходы на кредитной системы	2	R ₂₁																			
(2) Финансовый баланс	(5) Поступления из финансово-кредитной системы	3																				
	(6) Поступления от хозяйственных единиц	4																				
	(7) Поступления от населения	5																				
	(8) Финансовый оборот	6																				
	(9) Передачи в финансово-кредитную систему	7																				
	(10) Передачи хозяйственным единицам	8																				
	(11) Передачи населению	9																				
	(12) Доходы и расходы населения	10																				
	(13) Перераспределительные платежи	11																				
	(14) Личное потребление	12																				
(17) Финансовый баланс накопления	(15) Потребление учреждений производственной сферы	13																				
	(16) Финансирование накопления	14																				
(24) Баланс внешне-экономических связей	(17) Финансирование накопления	15																				
	(18) Финансирование накопления	16																				
(27) нераспределено	(19) Доходы и расходы производственной сферы	17																				
	(20) Доходы и расходы производственной сферы	18																				
(28) Итого	(21) Доходы и расходы производственной сферы	19																				
	(22) Доходы и расходы производственной сферы	20																				
		21	R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇	R ₈	R ₉	R ₁₀	R ₁₁	R ₁₂	R ₁₃	R ₁₄	R ₁₅	R ₁₆	R ₁₇	R ₁₈	R ₁₉	R ₂₀

Figure 5. Reflection of the nonproduction-oriented area in an integrated system of national economic balances [Key on following page]

- KEY:
- (1) Material balance
 - (2) Financial balance
 - (3) Income and expenditure in the production-oriented area
 - (4) Income and expenditure in the nonproduction-oriented area
 - (5) Payments from financial credit systems
 - (6) Payments from economic units
 - (7) Personal payments
 - (8) Financial turnover
 - (9) Transfers to financial credit system
 - (10) Transfers to economic units
 - (11) Transfers to population
 - (12) Personal income and expenditure
 - (13) Redistributing payments
 - (14) Consumption balance
 - (15) Personal consumption
 - (16) Consumption of institutions of the nonproduction-oriented area
 - (17) Consumption balance
 - (18) Financing of consumption
 - (19) National economy
 - (20) Nonproduction-oriented area
 - (21) Forms of consumption
 - (22) National economy
 - (23) Nonproduction-oriented area
 - (24) Balance of foreign economic ties
 - (25) Goods
 - (26) Money
 - (27) Not distributed
 - (28) Total

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INTRODUCTION OF NEW TECHNOLOGY

MULTIFACETED PROBLEMS RELATING TO NEW TECHNOLOGY REVIEWED

Economic Contradictions

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[Article by V. M. Likhtenshteyn: "On the Economic Contradictions When Producing New Equipment"]

[Text] In the article a theoretical analysis of the public, collective and personal interests, which form in the process of the production and use of new equipment, is given. The essence of the economic contradictions, which arise between enterprises when formulating and implementing the plans of the preparation of the production and assimilation of new items, is revealed.

The suggestion on the expedience of broadening the planned activity of scientists and developers up to the stage of the direct introduction of new machines in production, which will contribute to the resolution of the nonantagonistic economic contradictions between enterprises when producing new equipment, is substantiated.

The problem of the assimilation of new types of equipment is becoming more and more urgent as the industrial might of the country increases.¹ At the 26th CPSU Congress attention was directed to the intolerable slowness in the assimilation of promising developments [4]. What is the cause of the formed situation, why does the process of the production and assimilation of new machines poorly lend itself to planned regulation? The lack of a scientifically sound standard base for the planning of measures on assimilation, the inadequate study of the needs for new equipment, the probabilistic nature of the forthcoming expenditures on its production and so forth are usually cited. The indicated circumstances actually do complicate the process of formulating the plan assignments on the production of new equipment. But the basic reason consists in the inadequately elaborated methodology of planning the process of assimilating the production of new machines.

The fact that the problem of planning the process of the production and assimilation of new equipment is still attracting everyone's attention, gives reason to assume that the existing approaches to its solution are insufficiently effective. The main drawback of these approaches, in our opinion, is that they do not direct attention to the most complete reflection of economic interests in the plan, in connection

with the development of new machines. This occurs, in particular, due to the fact that various kinds of shortcomings, which occur in the practice of the planned management of scientific and technical progress, are taken as contradictions. In economic literature attention is directed to such an interpretation of contradictions [6].

The identification of economic contradictions with the shortcomings of planning leads to the incorrect idea that all the activity on the planned regulation of the process of developing new machines reduces merely to the elimination of the obstacles which arise in the practice of management when implementing the plans. Such an interpretation of these contradictions does not identify the fundamental factors which give rise to the phenomena of economic activity. Indeed, economists have been discussing for some time the question of the lack of assets (initially the assimilation fund, then the unified fund for the development of science and technology) at the manufacturing enterprises of new equipment for the implementation of measures on the series assimilation of new machines. During this time many suggestions have been made on the questions of the sources of the formation of these funds, the determination of their amounts and the directions of use. However, the problem of the financial backing of the processes of the assimilation of new equipment so far has not been completely solved. Apparently, it is impossible to solve this problem only by the methods of financial planning without the enlistment of other methods of the planned management of scientific and technical progress. Here, in our opinion, for all the levels of management the functions on the formulation and implementation of the plans of the development of new equipment should be regarded (owing precisely to the broad range of operations which are performed by the workers of the corresponding state organs) as a specific type of activity, which influences the formation and development of the economic interests which originate in connection with the production of new machines.

The activity on the formulation of the plans on new equipment directly influences the system of production relations with regard to the development of new equipment and is itself a component of them. These relations develop according to the following scheme: the formation of interests, the appearance of contradictions--the drafting of the plan as a tool of the elimination of the contradictions.

Before speaking about the economic contradictions which come to light in connection with the development of new equipment, it is necessary to dwell on the examination of the system of economic interests (public, collective and personal) with regard to the production of new machines.

Both the manufacturing enterprises and the user enterprises are interested in new equipment as an object of consumption in production, and the public interest in the development of new machines appears in this unity of interests. Specific material interests, which reflect the aspiration of each participant in the process of developing new equipment to have a certain portion of the material wealth both for the meeting of the vital needs connected with the reproduction of manpower and for the expanded (on a new technical basis) reproduction of the fixed production capital of the enterprise, which makes it possible to realize the aptitude of the worker for labor under more favorable conditions, are the basis for the economic interests of the developers of new equipment. These material interests reflect the needs of the workers, who create the new equipment, for items of not only personal consumption, which are necessary for the biological reproduction of their manpower, but

also consumption in production--the means of production, which act as the conditions of the very process of production, or, in other words, the production conditions. In turn the economic interests of the creators of new equipment act as the economic conditions, which ensure the fulfillment of the plans of the development of new equipment or the obtaining by the participants in this process of a certain portion of the national product. The creators of new equipment as participants in the process of social production "are included in the system of objective economic relations. They do not simply contemplate these relations, but live and act as the vehicles of these relations" [8]. In this sense the change of the economic conditions of production in connection with the changeover to the production of new machines is perceived by the participants in this process as something introduced from outside, which upsets the established rhythm of production and decreases the overall indicators of economic activity. But it is a matter, of course, not only of this. The main thing is that the change of the economic conditions of production, which is due to the process of the assimilation of new equipment, affects the conditions of the reproduction of the manpower of the participants in this process, which leads to the emergence of contradictions in economic interests with regard to the development of new equipment of the manufacturing enterprises and the user enterprises.²

In economic literature various opinions are expressed with regard to the differences of the interests, which originate in connection with the production of new equipment. Some authors note the inadequate coordination of the interests of individual enterprises, associations and sectors with the national economic interests [11], others stress the contradiction of the interests of the producers and users of the new equipment [10]. The essence of the contradictions of the economic interests, which originate with regard to the production of new equipment, is examined most thoroughly by B. Smirnov. While linking these contradictions with the noncoincidence of national economic and cost accounting interests, he also indicates: "such a contradiction originates because the economic impact of the new equipment being produced, as a rule, is realized beyond the manufacturing enterprises, while for themselves the updating and the increase of the quality of products increase the production costs" [12].

Given such a statement of the problem--the opposition of the cost accounting interests of the enterprises which produce new equipment to the national economic interests--the latter are as if identified with the economic interests of the enterprises which use the new equipment. Of course, the economic interests of the enterprises which use new machines for the most part reflect the national economic interests with regard to the production and assimilation of new equipment, but there might also not be a complete coincidence between them. For example, when the unquestionable advantages of new machines (from the point of view of the socioeconomic impact obtained from their use) owing to various circumstances are not discerned when evaluating the economic activity of the enterprise which uses the new machines,³ the coincidence of the economic interests of the latter with the national economic interests does not occur. The following is also possible: due to the inadequate readiness to realize all the advantages of a new machine the user enterprise cannot achieve a substantial decrease of the cost of the product being produced by it. Under these conditions the user enterprise's interest in new equipment decreases noticeably, the increase of the contradictions in the process of the production and assimilation of new equipment between the manufacturing and user enterprises is a consequence of this. On the surface of things these contradictions appear as the

differences in the expenditures on the production of new equipment and its previously produced analogues, which economists indicate [12]. The above-mentioned authors see the means of resolving and eliminating the economic contradictions between enterprises with regard to the production and assimilation of new equipment in the opportunities which have now been afforded to recover the expenditures on assimilation by means of the assets of the economic stimulation funds, as well as by the consideration of the value of the operations of an industrial nature in the total volume of output being produced. Of course, the availability in the necessary amounts of assets of the economic stimulation funds (particularly the assets of the unified fund for the development of science and technology) will improve somewhat the economic conditions of the development of new machines, which will have a positive influence on the nature of the contradictions which emerge when developing new equipment--they will become less acute. But these contradictions will not disappear completely, since the measures on the financial backing of the process of the production and assimilation of new equipment, among which there is also the financing of this process from the assets of the unified fund, have a limited effect on the formation of the value of the product of labor in the process of the preparation of the production and the assimilation of new equipment.

The organizational economic and the material and technical conditions for the development of new equipment are the product of the labor of the group for the preparation of the production of the enterprise for the making of new machines. Not being an object of realization, this special product of the labor of the group for the preparation of production is also not a commodity, but it has a value and accordingly a use value.⁴ It is possible to influence substantially the resolution of the contradictions with regard to the production and assimilation of new types of equipment precisely through the active influencing of the process of the formation of the value and use value of this special product of the labor of the group for the preparation of production. Such an approach follows from the well-known conclusion of Marx that the contradiction between the value and use value of a commodity is the basis for all economic contradictions.⁵ Soviet economists also indicate the decisive place of the contradiction of value in the system of contradictions of the commodity [6, p 5].

What do the contradictions between the value and the use value of the product of the labor (the organizational economic and the material and technical conditions of the development of new machines) of the group for the preparation of production consist in?

The expenditures of labor and materials per unit of an item during the period of the preparation of the production and the assimilation of a new machine differ from the analogous expenditures during the period of adjusted production. With respect to the material expenditures the excess arises due to the need to purchase additional equipment and accessories (which are frequently used only directly during the period of the preparation of production), with respect to labor expenditures--due to the need to resort to outside services (the conclusion of contracts with scientific and planning and design organizations) and the change of the rhythm of the labor activity of the group for the preparation of production at the enterprise (especially under the conditions of the initial assimilation of an innovation).

Since, as K. Marx wrote in his day: "The exchange value does not coincide with quality. The most useful things, such as knowledge, do not have an exchange

value" [2], a contradiction arises between the value and the use value of the product of the labor of the group for the preparation of production, that is, between the manufacturing enterprise and the user of the new equipment.

In reality from the standpoint of society and the user enterprises, which to a certain extent embody the needs of society for new equipment, the use value of the product of the labor of the group for the preparation of production is of unquestionable interest, since the materialization of previously solved technical problems is accomplished and the socioeconomic impact of future machines is established precisely at the stage of the preparation of production. These new solutions of the corresponding technical problems will be used subsequently at other enterprises, but all the same the manufacturing enterprise performed the work on the creation of the conditions for the implementation of these decisions, which required of the latter additional expenditures of manpower and material resources.

Meanwhile, of all the diversity of consumer properties of this special product of the labor of the group for the preparation of production the manufacturing enterprise of the new equipment itself uses only one thing--the readiness of the enterprise to begin the series production of new machines.

Of course, the solutions of new technical problems, which have been obtained by the manufacturing enterprise in the process of the preparation of production, can be used by it in the future. During the period of the preparation of production and the series assimilation of new machines the manufacturing enterprise bears increased expenditures, which are connected with the formation of the technical level of production of the enterprise, which corresponds to the forthcoming production of new equipment. The diversion of manpower and material resources for the implementation of measures on the preparation of production and the assimilation of new items occurs, which frequently leads to the worsening of the overall indicators of the economic activity of the enterprise and accordingly to the decrease of the payments from the material incentive funds.

Thus, at the Moscow Krasnyy proletariy Plant during 1972-1973 even in case of the very thorough preparation of production for the output of one of the machine tools of a new model a decrease of the overall, including the fund-forming, indicators of the economic activity of the enterprise occurred, which entailed a decrease of the amount of the material incentive fund. Given the significant increase of the expenditures on the preparation of production--42.8 percent in 1973 as compared with 1972--the estimated profitability decreased from 31.4 to 16.7 percent, the fulfillment of the plan on production decreased accordingly from 102 to 100.3 percent, the new profit--by 28.3 percent, while the amount of the material incentive fund--by 16.5 percent.⁶ Meanwhile if we consider that the complication of the content of labor during the period of the preparation of production and the assimilation of a new item makes increased demands on the work of all categories of workers, it is possible to come to the conclusion that the remuneration for labor during this period should not only not decrease, but should even increase slightly. It is also impossible not to take into account factors of a moral nature, for example, the possibility of losing a prize-winning position in the socialist competition, the decrease of prestige among the enterprises of the sector and region.

Thus, the contradiction between the value and the use value of the product of the labor of the group for the preparation of production appears first of all in

the decrease of the interest of the manufacturing enterprise of the new equipment in its production. In other words, the economic interests of the manufacturing enterprises of new items are connected precisely with the resolution of the contradictions between the value and the use value of the product of the labor of the group for the preparation of production. How is one to influence the formation of the value of the product of the labor of the group for the preparation of production for the output of new equipment so that "the internal opposition of the use value and the value, which is concealed in a commodity" [3] would not give rise to a negative attitude of the collective of the manufacturing enterprise toward production of new equipment? The methods of the planned regulation of preparatory processes for the production of new equipment could become a means of such influence. In this case it should be a question of measures on the comprehensive planning of preparatory processes, which cover the questions of not only the material, technical, personnel and financial backing of the process of the production of new machines, but also the place and time of their implementation. It is specifically a matter of the carrying over of the sphere of the application of capital and efforts from the directly production stages of the development of new equipment to the preproduction stages--scientific research, designing, the development of the technology, the checking of the assemblies of the new machine in pilot production. Such a reorientation of capital and efforts presumes the development of new designs of machines, which are distinguished by not only the novelty of the solution of the technical problem, but also a high level of the standardization of the assemblies and parts, and at the stage of the technological preparation of production--the taking of steps which are aimed at increasing the technological equipment of the production of a new item, which will make it possible to decrease the time and expenditures on its assimilation and production. For example, owing to the increase of the level of standardization of materials-handling machine building by only 4 percent it was possible to shorten the time of the designing and assimilation of the production of overhead cranes on the average by 11 percent, portal cranes--by 14 percent, gantry cranes--by 15 percent, electric hoists--by 6 percent. The cost of planning and design work and the time spent on the assimilation of the production of the items decreased accordingly [16].

But the change of the sphere of application of capital to the carrying out of preparatory processes requires a change of the functional ties at the stage of the preparation of production. Initially the mandatory broadening of the functions of researchers and developers is necessary, their activity should encompass the processes of the introduction of innovations under the conditions of a specific works as the final stage of their work.⁷ It is a question not simply of the mechanical redistribution, the change of the sphere of application of the capital, which is being allocated for the financing of preparatory processes, but also of the planned evaluation of the activity of the workers of scientific research institutes and design bureaus with allowance made for the fulfillment of the assignments on the series assimilation of new machines. In this case the activity of the researchers and the developers of new equipment during the entire stage of applied research, designing and the development of technology will be oriented toward the end result--the actual introduction of innovations in industrial production.⁸ In this case the number of prototypes of new machines, which have not been brought to the stage of series production, will decrease, which in itself will attest to a certain saving of all types of resources of society in case of the production of new equipment.

The range of activity, which is carried out in a planned manner, of the applied scientific research planning and technological organizations, which fulfill the corresponding assignments on the development of new types of machines, the production of which is envisaged by the plan of production of new equipment of enterprises, should be broadened. The planned activity of researchers and developers should not, in our opinion, be confined to the transfer to the services for the preparation of production of enterprises of the corresponding documents on the production of a prototype or to the study of the results of the industrial tests of prototypes of new models of machines. The scientific and engineering support of the process of the assimilation and production of a new machine under the conditions of a specific enterprise, which is producing the given item for the first time, should be the concluding stage of the theme being fulfilled by the researchers and developers. From this point of view it is expedient, in our opinion, to regard the thematic plans of scientific research work and of planning and technological organizations, which are taking part in the development of new types of machines, the production of which is envisaged by the plan of the production of new equipment of the given enterprise, to be fulfilled only if this equipment has been assimilated in series production.

Such an evaluation of the activity of researchers and developers will objectively entail some redistribution of all the types of resources, which are necessary for the production of the new equipment, from the production stages of its development to the preproduction stages. As a result of the more careful performance of the entire set of preparatory operations the likelihood of the timely fulfillment by the manufacturing enterprise of the new equipment of the outlined plan assignments on its production with fewer outlays of the enterprise's own capital will increase, which will contribute to the resolution and elimination of the contradictions between the manufacturing and user enterprises of the new equipment. The point is that the inclusion in the evaluation of the planned activity of scientific research, planning and technological organizations of the operations connected with the scientific and engineering support of the process of the introduction of a new item in production will make substantial changes both in the content of the labor of the group for the preparation of production of the enterprise and in the formation of the cost of the entire set of preparatory operations and the operations on the assimilation of the new item in production: the expenditures on the preparation of production and assimilation will decrease, while the content of the labor of the workers of the services for the preparation of production will approximate the labor under the conditions of the adjusted production of new machines.

Such approximation will become possible owing to the following circumstances.

First, the need for the performance by the workers of the services for the preparation of production of the enterprise of functions not characteristic of them, essentially of a research nature, which is the prerogative of the corresponding scientific research institutions, will disappear.

Second, the evaluation of the results of the planned activity of the workers of scientific research, planning and technological organizations with respect to the fact of the direct introduction of a new item in production will attract the attention of researchers and developers to the question of the consideration when developing and designing new machines of the possibilities of the production cooperation of the manufacturing enterprise of the new equipment and the allied enterprises, which supply the former with the necessary raw materials, materials and

semi-finished goods. The consideration of this factor at the initial stages of the preparation of production is a most important prerequisite of the stabilization and acceleration of the entire process of developing new machines.

Third, as a result of the completeness of the designs being executed by the researchers and developers it is possible to achieve the greater concentration of future expenditures of raw materials, materials and semimanufactures both on the preparation of the production of the new item and on its assimilation, which will make it possible to be on the verge of solving the problem of the standards of expenditures on the assimilation of new equipment.

It is necessary to differentiate the material and technical supply of the process of the development of the prototype and the process of the series production and assimilation of new equipment. Indeed, during the period of the development of the prototype the verification of the basic studies of the versions of the solution of new technical problems and of the methods of application of materials and semimanufactures, which, perhaps, were previously not used at the given enterprise, takes place. When it is a question of the changeover to the production of large batches of new machines, which is intended for years, the situation changes. In this case not only individual enterprises and scientific research organizations, but also entire sectors participate for a long time in a unified economic process. The economic consequences of possible changes of the designs of new machines and the technology of their production inevitably ensue not only for the manufacturing enterprise of the new equipment, but also to one extent or another for all the enterprises, which are connected by planning agreements and obligations with the manufacturing enterprise.

Of course, at the stage of the preparation of production it is not always possible to do without changes in the design and the technology of the production of a new machine, especially in those instances when these changes promise a significant economic impact. However, the acceptance of these changes by the planning organ of the sector and the enterprise should be accompanied by the careful ascertainment (including on the part of researchers and developers) of the possibilities of all the suppliers and coperformers, who are involved in the production of the new item, in the area of the supply of the manufacturing enterprise of the new equipment with everything necessary. Only in this case will the measures on the introduction of the innovation be implemented in strict conformity with the periods envisaged by the plan. It is also important that the ascertainment of the possibilities of suppliers as a condition of the drafting of the plan of the preparation of production creates the prerequisites for the greater substantiation of the plans of the financing backing of the process of the preparation of production, which is a most important condition of the creation of favorable economic conditions for the production of new equipment.

But not only the named advantages attest to the advisability of including the stage of the production introduction of an innovation in the planned activity of sectorial scientific research organizations. The main thing is that in case of such an approach to the planning of scientific research work the fundamental merging of the activity of the workers of scientific research organizations and the group of the preparation of production for the output of new equipment at a specific enterprise is achieved. At present the introduction of an innovation in series production is recorded only when evaluating the activity of the special design

bureaus or the design bureaus of enterprises, here the scientific research institutes are left as if out of the picture. The "attachment" of the sectorial scientific research institute to the process of the implementation of one innovation or another in series production makes it possible to eliminate the emergence of such situations when the special design bureaus or the design bureaus of enterprises, having been confronted with the fact of the inadequate study of one scientific and technical problem or another, are forced to complete it on their own.

The expansion of the planned work on the scientific and engineering support of the process of the preparation of the production of new machines up to the stage of series assimilation presumes the broadening of the sphere of use of the assets of the unified fund for scientific research work--these assets should, apparently, be channeled into the financing of not only the scientific research work, which is directly connected with the development of new equipment at the stage of scientific research and development, but also the work of scientists and developers on the introduction of the given innovation under the conditions of a specific works up to its series production.

At present the expenditures connected with measures on introduction, which are implemented by researchers and developers under the conditions of a specific works, are taken into account in the estimate of the expenditures on the elaboration of the detail and contractor designs of a new machine and are made in accordance with the item "Assimilation in Metal." The amount of these expenditures is determined by the ratio to the cost of the planning and design work and is included as a component of the amount of expenditures on the assimilation of new types of an item in the plan calculation of the cost of the production of its prototype. The possibilities of financing the activity of researchers and developers during the initial period of the series production of a new machine are limited due to the inadequate amounts of assets of the unified fund for the development of science and technology, which the enterprise has. Thus, when drawing up the plan calculation of the expenditures on the production of a prototype of a new machine at one of the machine tool building enterprises the proportion of the expenditures on the assimilation as a percent of its total production cost was taken to be 35.8 percent. The proportion of the analogous expenditures in the series version was planned in the amount of only 2.4 percent, which, in the opinion of the specialists of the enterprise, is inadequate. At the same time, since the increase of the proportion of the expenditures on the assimilation of the series production of a new item can lead to an increase of the prices for it, the broadening of the sphere of use of the assets of the unified fund for the development of science and technology for the financing of the set of operations connected with the assimilation of new equipment at the stage of its series production is necessary.

Thus, for the resolution of the economic contradictions, which originate when producing new equipment, and for the lending of greater completeness and finality to the process of the assimilation and production of new machines it is expedient:

- 1) to include in the sphere of the planned activity of the scientific research organizations, which participate in the fulfillment of the assignments on the development of new equipment which is being planned for production at a specific enterprise, the stage of its introduction in series production;
- 2) to evaluate the fulfillment of the plans of the scientific research work of the corresponding scientific research organizations or their subdivisions with allowance made for the fulfillment by the manufacturing enterprises of the new equipment of the plan assignments on its timely introduction in production.

Such an approach to the planning of the process of the assimilation of new equipment presumes, as has already been noted, some redistribution of the assets of the unified fund in favor of the financing of scientific research and planning and design work. But such redistribution does not at all mean that the total amount of the assets, which are being allocated from the unified fund of the sector for the needs of the development and assimilation of new equipment, will increase. The redistribution of the assets will occur owing to the reorganization of all the activity of researchers and developers on the scientific and engineering support of the process of assimilation. The very change of the nature of the activity of the subdivisions of the group for the preparation of production perforce will ensue as a consequence of the implementation of the new approach to the planning and evaluation of the activity of scientific research and planning and technological organizations.

FOOTNOTES

1. The rate of assimilation of new types of items is decreasing. At the end of the 10th Five-Year Plan the products, which had been assimilated for the first time in machine building, came to 2.5 percent as against 4.3 percent in 1970 [5].
2. It is characteristic that in philosophical and sociological literature it is also stressed that "the opposition of interests follows from the differences of economic conditions, which determine the content of the vital activity of some groups and classes or others" [9].
3. Thus, for the purpose of the more complete identification of the saving with respect to wages when substantiating the prices for new products it is proposed to take this saving into account with the inclusion of the funds of the free service of the population, which come to 40 percent of the wage [13].
4. "If a product or service is not sold and has not received public recognition through the system of commodity relations and the socialist market, no real public, group and personal appropriation will occur" [14].
5. When speaking, for example, about the dual existence of a commodity as a specific product and a product, "which in its physical form of existence ideally contains (contains in latent form) its exchange value," Marx noted that "this dual DISSIMILAR [in italics] existence should be developed further into a difference, the difference should be developed into OPPOSITION [in italics] and into a CONTRADICTION [in italics]" [1].
6. It should be noted that preparatory work of considerable scale (more than 600 units of new equipment were installed, the proportion of special equipment was increased to 30 percent, while that of automatic equipment was increased to 59 percent [15]) in 1974 had already enabled the collective of the enterprise to achieve a substantial increase of nearly all the indicators of economic activity, as a result the material incentive fund of the enterprise increased as compared with 1972 by 25.1 percent.

7. Scientists are directing attention to this circumstance. "The interests of the matter require that scientific research in the area of the development of new technological processes would culminate in their complete preparation for industrial introduction. The study being conducted by a sectorial institute can be considered completed only when the entire material basis of new technology, including the production, completion and operational development of the prototypes of new equipment, has been developed" [17].
8. At the preproduction stages of the development of new equipment, apparently, the proportion of the operations on the development of the technology of producing the future machine increases. Now the proportion of these operations is relatively small, to which the estimate of the expenditures on scientific research and experimental design work at one of the machine tool building enterprises in 1980 attests. The structure of the expenditures of the enterprise on the performance of these operations was broken down in the following manner: designing--75.3 percent, production engineering--24.7 percent.

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Evaluation of Economic Efficiency

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[Article by S. A. Nikitin and Ya. V. Safronov: "The Improvement of the Methods of Evaluating the Economic Efficiency of New Equipment"]

[Text] The questions of the further improvement of the methodology of the economic substantiation of new technical decisions are examined in the article. For the purposes of the more complete consideration of the social expenditures when calculating the amount of adjusted expenditures it is proposed in addition to take into account the labor factor in the form of the amount of used manpower.

The intensification of the economy and the utmost increase of production efficiency are the most important socioeconomic task of the present stage of the building of communism. The acceleration of scientific and technical progress, as was emphasized at the 26th CPSU Congress, should also be subordinate to the accomplishment of this task. It is a question of the acceleration of the retooling of production, its complete mechanization and automation, the quickest possible development and introduction everywhere of fundamentally new equipment and materials, the use on an extensive scale of highly productive energy- and material-saving equipment and technology.

During the 11th Five-Year Plan the rate of the replacement of equipment should be sped up by approximately 1.5-fold, which will make it possible to increase the level of the demands which are being made on its quality. "Conformity to the best world and domestic examples--we cannot and should not agree to anything less. It is necessary to accustom oneself to this, it is necessary to strive for this, by resolutely rejecting everything that is obsolete, backward and has been reduced in price by life itself," it was noted in the Accountability Report of the CPSU Central Committee to the 26th congress [1]. For this it is necessary to make more rigid the system of the evaluation of the economic and technical level of new technological processes, machines and equipment.

Socialist society is interested in the development first of all of those directions of scientific and technical progress, which, while speeding up the growth rate of labor productivity, at the same time make it possible to solve social problems. In this connection the elaboration and introduction of scientifically sound methods of determining the total national economic impact are one of the important strategic tasks in the area of the management of scientific and technical progress. The making of a complete, accurate economic calculation for the adoption of the correct version of a decision when developing and introducing fundamentally new, competitive equipment and technology is of particular importance.

In the area of economic studies of scientific and technical progress the indicated problem still requires its solution. Up to 1977 the making of calculations on the substantiation of the versions of technical decisions in the USSR was regulated by a large number of methods and instructions, which frequently contained contradictory methodological questions. This concerned the interpretation of such important questions as the concept of the overall (absolute) and comparative efficiency, the norm of the effectiveness of capital investments, the reduction of current and one-time expenditures to equivalent expenditures in accordance with the time factor, the period of the accounting of the economic impact from the moment of the production of new equipment and others.

For the elimination of the procedural diversity in the calculations of the economic efficiency of new equipment, inventions and rationalization proposals the USSR State Committee for Science and Technology, the USSR Academy of Sciences and the USSR Committee for Inventions and Discoveries jointly with the USSR State Planning Committee, the USSR Ministry of Finance, the USSR State Committee on Prices and the USSR Central Statistical Administration drew up and approved the corresponding method (see [2]). Its advantages as compared with the previously used methods have been covered quite extensively in the press (see, for example, [3]). However, one should dwell on the still unsettled questions of the improvement of the methodology of the economic substantiation of technical decisions, the answers to which are not contained in the above-named method. It is a question first of all of the need for the more complete consideration of public expenditures when calculating the amount of the adjusted expenditures, in accordance with the difference of which the annual economic impact is determined; the conformity of the values being calculated of the impact of the technological process being adopted and the impact of the machines, devices and instruments, which are being newly created for the implementation of this technological process; the calculation of the impact of the use of new materials which influence the technical and economic indicators of the machines and equipment which are being developed; the choice of the reference year for the determination of the indicators of the efficiency of new equipment in the sphere of its use and others.

Let us examine in somewhat greater detail the possible means of accomplishing the enumerated tasks.

The method now in effect [2] envisages the estimation of the economic efficiency at all levels of the development and use of new equipment and technology in accordance with the indicator of the economic impact for the national economy, which is determined in accordance with the difference of the adjusted expenditures. Let us recall that the adjusted expenditures are the sum of the production cost and the standard profit:

$$3 = C + E_H K, \quad (1)$$

where 3 is the adjusted expenditures of a unit of a product (work), rubles; C is the production cost of a unit of a product (work), rubles; K is the specific capital investments in productive capital, rubles; E_H is the standard coefficient of the effectiveness of capital investments, which is equal to 0.15.

The developments of labor-saving equipment: means of mechanization, automation and mechanical manipulators (robots), are playing a greater and greater role for the assurance of the steady increase of labor productivity, which makes it possible to increase the economic efficiency of social production under the conditions of the decline of the growth of manpower resources. All this is capital-consuming developments. Thus, according to the data of enterprises and associations of the Ministry of the Chemical Industry, 28,000 rubles of capital investments are required for the freeing of 1 worker by means of the introduction of means of mechanization [4]. As a result, in practice the mechanization and automation of production frequently do not yield an economic impact. Many economists see the cause of this negative phenomenon in the fact that the wage of the workers being free in case of the introduction of new equipment, which is taken into account in the production cost of the product and accordingly in the adjusted expenditures, does not reflect the considerable expenditures of society on the reproduction of manpower and the increase of the well-being of the working people from public consumption funds. Indeed, the payments and benefits from public consumption funds in the USSR come to a large amount. For example, in 1980 the average wage of workers and employees in the national economy came to 168.9 rubles a month, while with allowance made for the payments from public consumption funds--232.8 rubles [5]. Consequently, the average wage of workers and employees with allowance made for the payments and benefits from public consumption funds is approximately 1.38-fold greater than the average wage which is taken into account in the production cost of a product. On this basis in some ministries it is permitted as an experiment when calculating the economic efficiency of new equipment to increase the wage of the workers being freed by 1.35-fold [4]. However, such an increase of the wage in the calculations of the efficiency of new equipment, in our opinion, is inadvisable for the following reasons.

First, in case of the freeing of the workers of an enterprise as a result of the introduction of new equipment the amount of the payments and benefits from public consumption funds practically does not change. This is connected with the fact that the public funds are planned on the basis of the need for the meeting of the needs of the population of the country, while the payments are made for the most part from the state budget.

Second, the legitimacy of increasing the wage in the calculation of the efficiency of new equipment would arise if the payments from public consumption funds were

included in the production cost of the product. The increase of the production cost would lead to a change (decrease) of the value of the standard coefficient. In turn the increase of the production cost and, consequently, the prices for new equipment would lead to a decrease of the economic impact of its introduction. For these reasons it is inadvisable to take into account in the production cost the payments and benefits from the incentive funds of the enterprise (the material incentive fund and the fund for sociocultural measures and housing construction).

In a number of instances for the purpose of increasing the economic efficiency of new labor-saving equipment the need for the consideration of not only the wage, but also the entire surplus product (profit) is emphasized. Here they are guided by the fact that as a result of the introduction of new equipment the manpower being freed creates a surplus product at other workplaces and enterprises. The authors of work [3] consider such a proposal unacceptable for the reason that the profit created by freed workers will be the profit not of the given, but of another enterprise, for which additional means of production, which are paid for with this profit, will be required.

However, it is impossible to take into account the surplus product in the calculation of the efficiency of new equipment not only for the indicated reason. In our opinion, there is another, decisive reason, which does not make it possible in accordance with the prevailing method of determining the economic efficiency of new equipment to take into account the profit which is created by the workers being freed.

When elaborating the method [2] they were guided by the following basic principle--the assurance of a national economic approach to the choice of the optimum version of new equipment. Therefore the adjusted expenditures reflect the total national economic expenditures, that is, the aggregate expenditures of national labor. The latter, according to the definition of K. Marx, in case of the production of goods from the point of view of society are measured by the consumed labor:

$$3_{обм} = c + v + m, \quad (2)$$

where $3_{обм}$ is the public expenditures of the labor being consumed for the production of a unit of the product, rubles; c , v and m are the expenditures of respective embodied labor (the material expenditures), the necessary and surplus labor.

Since the adjusted expenditures (3) reflect the total national economic expenditures, that is, $3 = 3_{обм}$, there is the equality

$$C + E_H K = c + v + m. \quad (3)$$

By replacing the amount of the production cost C in the adjusted expenditures with the material expenditures and the amount of necessary labor (the wage), we will obtain:

$$c + v + E_H K = c + v + m. \quad (4)$$

If in the adjusted expenditures in addition to the wage one takes into account the profit which is created by the workers being freed in case of the introduction of new equipment, equality (4) will be correct only on the condition that $E_H K = 0$. In

this case the method of calculating the economic efficiency of new equipment in accordance with the difference of the adjusted expenditures is unacceptable.

Thus, the use of the adjusted expenditures for the estimation of the economic efficiency of new equipment does not make it possible in addition to take into account the labor factor. Meanwhile its consideration is necessary for the reason that the introduction of new equipment involves the change of not only the one-time expenditures on the creation of new capital, but also the amount of resources of manpower which is used in production. Under socialism manpower is not a commodity and does not have a market value, but the retention under socialism of commodity-money relations makes it possible to express its value as the one-time expenditures of socialist society, which are connected with the reproduction of manpower. These expenditures of society are quite large and should be taken into account when estimating the amount of resources of manpower which is used in the corresponding unit of the national economy. Let us note that the volume (amount) of resources of manpower, which is used in production, corresponds to the amount of living labor, which is involved in production in the national economic unit in question, or, in simplified terms, the amount of manpower being used. It is defined as the one-time state expenditures on its reproduction. One must not confuse the amount of manpower being used with the amount of living labor being used (the manpower being consumed), which is determined by the current state expenditures (for example, annual) in the form of payments from the wage fund, the economic stimulation funds and the public consumption funds.

In connection with the fact that the introduction of new equipment practically always involves a change of the number of workers and, consequently, a change of the amount of manpower being used in the corresponding unit of the national economy or in its subdivisions, it is possible to determine the amount of the adjusted expenditures in accordance with the formula

$$Z = C + E_H R + E_H K = C + E_H (R + K), \quad (5)$$

where R is the specific amount of manpower being used, rubles.

According to the procedural recommendations, which are set forth in works [6, 7], it is possible to calculate the specific amount of manpower being used at an enterprise or in its subdivisions and at the workplaces in accordance with the formula

$$R = (Z_{\text{дошк}} + Z_{\text{шк}} + Z_{\text{эдр}} + Z_{\text{культ}} + Z_{\text{пенс}}) N_0 + Z_{\text{пр}} N_{\text{пр}} + Z_{\text{проф}} N_{\text{проф}} + Z_{\text{сц}} N_{\text{сц}} + Z_{\text{вуз}} N_{\text{вуз}}, \quad (6)$$

where N_0 is the average annual number of workers of the unit in question, people; $Z_{\text{дошк}}$, $Z_{\text{шк}}$, $Z_{\text{пр}}$, $Z_{\text{проф}}$, $Z_{\text{сц}}$, $Z_{\text{вуз}}$, $Z_{\text{эдр}}$, $Z_{\text{культ}}$, $Z_{\text{пенс}}$ are the specific (on the average per child or worker) state expenditures (rubles per person) respectively on the support and education of children at preschool institutions; training at the general educational school; directly at the enterprise; at vocational and technical schools; at secondary specialized educational institutions; at higher educational institutions; on the provision of free services of health care and the organization of vacation; the public cultural and personal service of future manpower; on the support of retirees; $N_{\text{пр}}$, $N_{\text{проф}}$, $N_{\text{сц}}$, $N_{\text{вуз}}$ are the number of workers of the national economic unit in question, who received occupational skills respectively at the enterprise, at vocational and technical schools, at secondary specialized and higher educational institutions, people.

The values included in formula (6) are determined on the basis of published statistical data. Some of them may be taken as standard values regardless of the peculiarities of production.

The specific state expenditures on the support and education of children at preschool age will come to:

$$З_{дошк} = \bar{З}_{дошк} t_{дошк} = \frac{З_{дошк}}{N_{дошк}} t_{дошк}, \quad (7)$$

where $\bar{З}_{дошк}$ is the average annual state expenditures on the support and education of one child of preschool age, rubles/year; $З_{дошк}$ is the total state expenditures during the accounting year on the support of all children at the preschool institutions of the country, rubles/year; $N_{дошк}$ is the total number of preschool children in the country during the accounting year, people; $t_{дошк}$ is the length of the preschool period, which is equal to 7 years. The calculations made on the basis of the statistical data for 1980 show that $\bar{З}_{дошк} = 220$ rubles/year per person.

The specific state expenditures on the general educational and specialized training of manpower are determined in accordance with the formulas

$$З_{шк} = \bar{З}_{шк} t_{шк}; \quad (8)$$

$$З_{пр} = \bar{З}_{пр} (t_{пр} + \Delta t_{пр}); \quad (9)$$

$$З_{проф} = \bar{З}_{проф} (t_{проф} + \Delta t_{проф}); \quad (10)$$

$$З_{сц} = \bar{З}_{сц} (t_{сц} + \Delta t_{сц}); \quad (11)$$

$$З_{вуз} = \bar{З}_{вуз} (t_{вуз} + \Delta t_{вуз}), \quad (12)$$

where $\bar{З}_{шк}$, $\bar{З}_{пр}$, $\bar{З}_{проф}$, $\bar{З}_{сц}$, $\bar{З}_{вуз}$ are the average annual state expenditures on the average per student respectively at the general educational school, at the enterprise, at vocational and technical schools, at secondary specialized and higher educational institutions, rubles/year; $t_{шк}$, $t_{пр}$, $t_{проф}$, $t_{сц}$, $t_{вуз}$ are the average length of training of the contingent of workers in question at the general educational school, workers who are trained directly at the enterprise, at vocational and technical schools, secondary specialized and higher educational institutions, years; $\Delta t_{пр}$, $\Delta t_{проф}$, $\Delta t_{сц}$, $\Delta t_{вуз}$ are the time necessary for the practical mastering of the specialty obtained in the process of training, that is, the length of service, years.

The amount of the average annual state expenditures per student by types of educational institutions, according to the data of the statistical yearbook "Narodnoye khozyaystvo SSSR v 1980 g. [The USSR National Economy in 1980], came to (rubles per year):

$$\bar{З}_{шк} = 200; \bar{З}_{пр} = 712; \bar{З}_{сц} = 700; \bar{З}_{вуз} = 1,000.$$

The amount of the average annual expenditures, which are connected with the vocational training of workers directly at the enterprise by means of individual, brigade and group instruction, is found on the basis of the expenditures of the enterprise on training and the number of trained workers during the accounting year.

The length of the socially necessary length of service for the mastering of an occupation ($\Delta t_{\text{пр}}, \Delta t_{\text{проф}}, \Delta t_{\text{сс}}, \Delta t_{\text{вуз}}$) depends on the forms and terms of training, the type of occupation and others. These amounts can be determined by expert means or can be taken in consolidated calculations as standard amounts. For example, on the basis of practice it is possible to assume that for the mastering of working class occupations $\Delta t = 0.5$ year, for engineering and technical occupations $\Delta t = 1$ year.

The specific state expenditures, which stem from the provision of free services of health care and the organization of vacation, as well as the public cultural service of future manpower, will come to

$$З_{\text{эдр}} = \bar{З}_{\text{эдр}} t_{\text{н}}, \quad (13)$$

$$З_{\text{культ}} = \bar{З}_{\text{культ}} t_{\text{н}}, \quad (14)$$

where $\bar{З}_{\text{эдр}}, \bar{З}_{\text{культ}}$ are the annual state expenditures on the average per worker for providing services on health care and the organization of vacation, as well as on public cultural and personal service, rubles/person; $t_{\text{н}}$ is the average age of the start of labor activity of the workers of the given works, years.

The annual state expenditures per person are determined according to the available statistical data or by estimation:

$$\bar{З}_{\text{эдр}} = \frac{З_{\text{эдр}}}{N_{\text{н}}}; \quad (15)$$

$$\bar{З}_{\text{культ}} = \frac{З_{\text{культ}}}{N_{\text{н}}}, \quad (16)$$

where $З_{\text{эдр}}, З_{\text{культ}}$ are the state annual expenditures during the accounting year, which were allocated respectively for health protection and the organization of vacation, as well as the cultural and personal service of the population, rubles/year; $N_{\text{н}}$ is the size of the population of the country during the accounting year, people.

The calculated values of the indicated amounts according to formulas (15) and (16), according to the data of the statistical yearbook "Narodnoye khozyaystvo SSSR v 1980 g.," came to (per person)

$$\bar{З}_{\text{эдр}} = 77 \text{ rubles/year}; \bar{З}_{\text{культ}} = 53 \text{ rubles/year}.$$

The average age of the start of labor activity of all the workers of the corresponding works is determined according to the formula

$$t_{\text{н}} = 7 + \bar{t}_{\text{обр}}, \text{ years}, \quad (17)$$

where 7 is the average age of the children who are starting studies at the general educational school; $\bar{t}_{\text{обр}}$ is the length of the period of general and specialized education on the average of the workers of the works in question, years.

This length is found as the weighted average length of training times the educational level of the workers of all categories:

$$\bar{t}_{\text{обр}} = t_{\text{шк}} + d_{\text{пр}} t_{\text{пр}} + d_{\text{проф}} t_{\text{проф}} + d_{\text{сс}} t_{\text{сс}} + d_{\text{вуз}} t_{\text{вуз}}, \quad (18)$$

where d_{np} , $d_{проф}$, d_{cc} , $d_{выз}$ are the proportion of workers of the works, who received vocational training at enterprises, at vocational and technical schools, secondary and higher educational institutions.

The average length of training at the different educational institutions t_{np} , $t_{проф}$, t_{cc} , $t_{выз}$ is determined in accordance with the statistical data which characterize the level of education of the workers at the works in question.

The length of the period of general and specialized training on the average of one worker in the country in 1980 came to 10.7 years, that is, $\bar{t}_{обp} = 10.7$ [8].

The specific state expenditures, which are connected with the support of workers at nonable-bodied age, that is, after retirement, are calculated according to the formula

$$З_{пенс} = (\bar{З}_{пенс} + \bar{З}_{здр} + \bar{З}_{культ}) t_{пенс}, \quad (19)$$

where $\bar{З}_{пенс}$ is the annual expenditures on the average per person for the payment of a pension, rubles/year; $t_{пенс}$ is the average length of the receipt of a pension by workers of the works in question, years.

The annual amount of the pension, which is paid on the average to a worker of the works in question, is defined as

$$\bar{З}_{пенс} = \bar{V}_{зп} \epsilon, \quad (20)$$

where $\bar{V}_{зп}$ is the average annual amount of the wage of a worker of the works in question during the accounting year; ϵ is the proportion of the wage, which is established by legislation and is taken into account when determining the amount of the pension.

The average length (in years) of the payment of a pension to workers comes to

$$t_{пенс} = t_{ж} - t_{вых}, \quad (21)$$

where $t_{ж}$ is the life expectancy of the worker; $t_{вых}$ is the average retirement age of the worker.

Life expectancy in our country for men comes to 64 years and for women to 74 years. The average age of the workers retiring under normal working conditions is equal for men to 60 years and for women to 55 years.

Thus, all the components of the state expenditures, which are necessary for the calculation of the amount of manpower being used, have been determined.

Let us emphasize that with allowance made for the amount of manpower being used in formula (5) of the adjusted expenditures the value of the standard coefficient of efficiency will be considerably less than 0.15. This is explained by the fact that this coefficient will be determined by the ratio of the gross surplus product, which is created in the national economy as a whole, to the sum of the value of the fixed production capital and the manpower being used, that is, as the profitability of production resources. As the calculations of the profitability of resources at

individual machine building enterprises (the ratio of the profit to the sum of the value of the productive capital and the amount of manpower being used) show, its amount fluctuates substantially from 3 to 13 percent. The low value of the profitability of resources stems from the fact that the amount of manpower being used exceeds by many times the wage fund, which is frequently used for the characterization of the volume of manpower being used. The amount of manpower being used at enterprises in value terms is comparable to the value of the productive capital, but frequently significantly exceeds it. Such great public expenditures, which are connected with the creation of manpower resources, require the more efficient use of the latter in all the units of the national economy and the revision of the prevailing method of calculating the economic efficiency of the measures aimed at the saving of living labor, including the introduction of means of the mechanization and automation of production.

The proposed method of calculation will make it possible to determine more completely the national economic efficiency of new equipment. Let us note that in conformity with the prevailing method mainly only the cost accounting economic impact is taken into account when estimating the efficiency of new equipment. The incomplete consideration of the impact frequently checks the assimilation of fundamentally new, labor-saving equipment and narrows unjustifiably the economic limits of its use. Specialists stress that according to the now used method of calculation in many instances robotics are insufficiently effective first of all due to the long payback periods. The general director of the Orel Prompribor Association responded to the question of a correspondent of the newspaper PRAVDA, whether there are redundant operations in the shops, as follows: "Yes, among such devices there are those which during the shift make half as many parts as a skilled worker, and the accounting reports attest: the equipment is inefficient. But there is also another calculation. A robot does not need housing, a dining room, transportation in order to get to work, it is not necessary to train it, while, having served its life, it will manage without a pension, for it will simply be turned into scrap metal. So, if you approach things not from a departmental, but from a statewide standpoint, if you take into account the saving on cultural, personal and housing construction and service, training, it will turn out that the unprofitable robot is extremely advantageous and efficient" [9].

In our opinion, the consideration in the indicator of adjusted expenditures of the amount of manpower being used will direct attention to the national economic approach to the evaluation of new equipment, extending thereby the scientifically sound limits of the use of new labor-saving equipment.

Another important question requires settlement: the evaluation of the efficiency of the machines, equipment, tools and other elements of the new technological process, which are being developed, automated systems and complexes. The calculation, which is recommended in the method [2], of the economic impact of the production and use of the enumerated elements, which are grouped with means of labor of long-term use, differs significantly from the calculations of the impact of a new technological process, mechanized and automated system. The annual impact of the latter is calculated on the basis of the annual volume of output during the accounting year, which was produced by means of a new technological process, the impact of the use of new elements of long-term use is calculated on the basis of the annual volume of production by means of these means of labor during the entire service life. Such a disparity of the methods of evaluation has the result that the estimated

efficiency of the same equipment, which, however, is used differently (independently or is included in a new technological process, system), differs by several times. Therefore it is possible to consider as entirely justified the suggestion (see [4]) about the need for the calculation of the impact of the use of new modes of production with allowance made for the service life of the basic equipment being used. Moreover, in order to avoid the repeated consideration of the impact of the introduction of new means and objects of labor, which are included as components in new technological processes and systems, their economic evaluation should be determined in accordance with the economic impact of the use of the new technological processes and systems, in which these elements are included.

In case of the national economic approach to the evaluation of new equipment one should take into account along with the direct economic impact also the social and foreign economic impacts. The direct economic impact is characterized by the saving of all types of production resources and, consequently, by the increase of the productivity of national labor. The social impact is characterized by the change of the conditions of the vital activity of society and its members. This impact promotes the elimination of difficult physical and monotonous labor, the more complete observance of ergonomic requirements, the increase of labor safety, the decrease of the harmful influence on the body of man of vibration, noises, toxic substances, the increase of the comfort of labor, the increase of the creative nature of labor, the facilitation of working conditions in everyday life, the increase of the free time of the population and others.

New competitive equipment makes it possible to obtain a foreign economic impact. It is possible to determine the amount of this impact on the basis of the calculation of the additional currency receipts from the export of competitive new equipment, the revenue from the sale of licenses of Soviet scientific and technical solutions, the saving of currency in case of the replacement of imported equipment with domestic equipment.

It is possible to calculate the enumerated types of impacts by a direct means on the basis of the technical and economic indicators of new equipment, as well as by the method of expert appraisals.

Moreover, when calculating the efficiency of new equipment, which is used for meeting the increasing demands of the population, it is necessary to take into account the so-called consumer impact, which at times is called the qualitative impact. It is achieved by means of the updating of the assortment of items, the improvement of their quality; the production of fundamentally new items and so on. This type of impact is manifested through the increase of the well-being of the people.

The introduction of scientifically sound methods of the evaluations of the integral national economic efficiency of new equipment, which differ substantially in accordance with the above-enumerated types of impact, will promote the extension of the economic limits of the use of new generations of machines and the successful accomplishment of the tasks on the increase of labor productivity, the saving of material resources and the increase of the exports to the world market of competitive equipment.

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Optimization of Service Life

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[Article by N. P. Makarkin: "On the Question of the Optimization of the Service Lives of Equipment"]

[Text] In the article the question of determining the optimum service lives of equipment is examined; a quantitative expression of the criterion of the optimization of the service lives is given and the need for the observance of a number of additional conditions when solving this problem is substantiated.

The determination of the economically governed length of the operating period of equipment is among the most complicated problems of the theory and practice of

optimum planning. The urgency of this problem at present is increasing significantly in connection with the acceleration during the 11th Five-Year Plan of the rate of the updating of equipment by approximately 1.5-fold, which was outlined by the 26th CPSU Congress [2]. The making of optimum decisions in this area envisages the use of models of the optimization of the service lives, which make it possible from the standpoint of the interests of the national economy to determine the advisable moment of the replacement of equipment.

The optimum service lives should meet the requirement of the most efficient use of national resources when producing and using equipment for the purpose of the most complete meeting of public needs. Therefore in general form the optimum service life is determined in accordance with the criterion of the minimum national economic expenditures per unit of the product (work) which is produced by means of this equipment. Such a formulation of the criterion of optimality usually does not arouse objections. The question of the means of calculating the expenditures, that is, the question of the quantitative expression of the criterion of optimality is debatable. Constructed in accordance with the principle of the minimization of expenditures, the criterion of optimality, in our opinion, should meet two requirements. First, it should include, when there are standards of the efficiency of national economic resources, in addition to the current expenditures the amount of the standard impact of all types of resources, which are used when producing and using equipment. Second, for the purpose of taking into account the influence of scientific and technical progress on the service lives the criterion should reflect the change in time of the real, replacement value of the equipment, which presumes the possibility of an objective estimate of the value of the equipment for any year from the set of alternative service lives. As is known, under the influence of obsolescence equipment gradually loses its value. In indicating this, K. Marx wrote: "If, for example, as a result of a new invention machines of a given type can be reproduced with a smaller expenditure of labor, the old machines more or less depreciate and therefore transfer to the product a relatively smaller value" [1]. This makes it possible to believe that in case of the optimization of the service lives of equipment it is impossible to determine the amount of the national economic expenditures during different periods of its operation, by adding to the initial value the operating costs during the service life in question, which are calculated by means of the discount coefficient. With allowance made for what has been said the optimum service life is found from the condition

$$\min 3_{\text{net}} = \min \left[C_{\text{rt}} + \frac{1}{t} \left(\sum_{i=1}^r (1 + E)^t \sum_{j=1}^n e_j v_{ijt} \right) - \Pi_t \right] \frac{1}{Q_{\text{rt}}}, \quad (1)$$

where 3_{net} is the national economic expenditures per unit of the product (work) being produced by means of the equipment in case of a service life equal to t ; C_{rt} is the average annual production cost of the product (work) being produced by the equipment in case of a service life equal to t , which is determined with allowance made for the time factor; n is the number of types of national economic resources, the efficiency of which is standardized on a public scale; e_j is the standard coefficient of the efficiency of type j of a resource; v_{ijt} is the amount of type j of a resource, which is used in the operation of the equipment during year t ; E is the standard of the adjustment of the nonsimultaneous expenditures and results; Π_t is the salvage value of the equipment during year t ; t is the service life in question, years; Q_{rt} is the average annual productivity of the equipment in case of a service life equal to t .

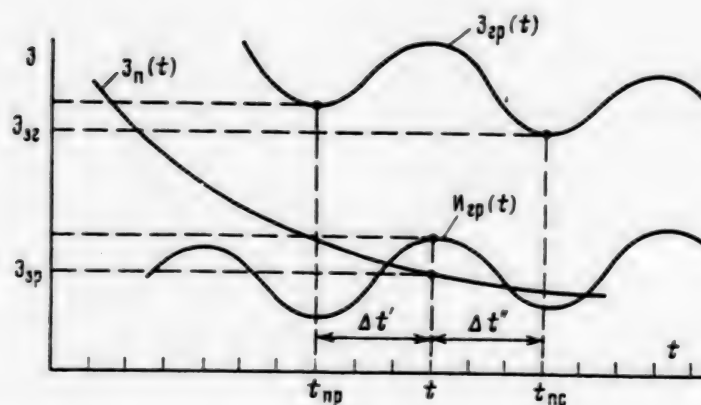
The average annual production cost of the product (work) which is produced by the equipment is formed by means of the average annual current operating costs and the amortization deductions for its complete replacement. In this case the amortization deductions for renovation for any (for example, t) year of the period in question are determined on the basis of the replacement value of the equipment during year t , while the rate of amortization is calculated in accordance with the formula of compound interest.

On the condition of the standardization on a public scale of the effectiveness of capital investments the amount of the standard impact of the capital investments of the consumer, which contains the value of the reproduction of equipment, which changes in time, should be reflected in expression (1). If we take into account the standard demands on the efficiency of manpower resources, as is recommended in works [3, 4], the total amount of the standard impact from the manpower resources and capital investments, which are used during the operation of the equipment during the service life, which is equal to $T(H_{3t})$, is determined in the form:

$$H_{3t} = \sum_{t=1}^T E_H (3_{nt} + K'_t) \cdot (1+E)^t + \sum_{t=1}^T E_L \Phi_{ot} (1+E)^t, \quad (2)$$

where E_H and E_L are the standard coefficients of the effectiveness respectively of capital investments and manpower resources; 3_{nt} is the national economic expenditures on the reproduction of equipment during year t (the replacement value of the equipment); K'_t is the associated capital investments of the consumer, which are evaluated in accordance with the replacement value during year t ; Φ_{ot} is the fund for the remuneration of the labor of the workers employed in the service and repair of equipment during year t .

However, as the analysis shows, the existence of the criterion of optimality, which is determined in accordance with formula (1), is not always an adequate condition for the finding of the optimum service life. In accordance with the criterion of optimality the choice of the advisable length of operation of equipment is possible only in two cases. The first of them presumes the monotonic, continuous decrease or increase in time of all the components of the criterion. Such a nature of the change in time of the components of the expenditures, which is often used in the models of the optimization of the service lives, in essence is unrealistic. As a result of the year-by-year change in the process of operation of the amount of the expenditures on the performance of repair work the total amount of the national economic expenditures is susceptible to considerable changes in time. In the system of coordinate axes time-expenditures the dependence of 3_{He} on time is a curve with many local minimums until the occurrence of the absolute minimum of these expenditures. This points to the fact that in individual years an excess of the annual amount of the expenditures on the performance of repair (reconditioning) operations over the replacement value of the equipment is possible before the occurrence of the absolute minimum of expenditures. Thus, the second case, when it is possible to determine the optimum service life in accordance with criterion (1), envisages the achievement of the absolute minimum of expenditures per unit of the product (work) before the annual expenditures on repair during some year exceed the replacement value of the equipment.



The change of the expenditures on the product (work) being produced by the equipment, which is really observable in dynamics, requires when finding the optimum service life before the achievement of the absolute minimum of these expenditures the comparison by years of the period being studied of the replacement value with the annual expenditures on the performance of repairs. If before the occurrence of the absolute minimum of the expenditures per unit of the product (work) during some (t) year of operation the expenditures on the performance of the repair of equipment exceed the expenditures on its replacement during the given year, the determination of the optimum service life requires the comparison of the possible saving of expenditures on repair in case of the replacement of the equipment during year t with the saving from the decrease of the expenditures on the product (work) being produced in case of the lengthening of the service life before the local minimum of these expenditures, which follows year t. It should especially be noted that in case of such a comparison only the decreasing local minimums of the expenditures are examined. Let us turn to a graphic interpretation of what has been said (the figure). Let us assume that the annual productivity of the equipment remains stable in time, then for greater clearness it is possible to use the absolute value of the annual national economic expenditures in case of the operation of the equipment ($3_{HO}(t)$). In the figure the function $3_{HO}(t)$ is examined on the section of the decreasing local minimums, the function $3_{nt}(t)$ is monotonically descending, which corresponds to the real dynamics of the value of the reproduction of equipment under the conditions of the increase of the productivity of national labor. During year t the amount of the expenditures on the performance of repair work (H_{rpt}) exceeds the amount of the replacement value by the amount 3_{3p} , therefore in case of the replacement of the equipment during the given year a saving of national economic expenditures, which is equal to it in amount, will be obtained. At the same time the lengthening of the service life from the year, during which the local minimum of expenditures (t_{np}), which preceded year t, is achieved, to the year which corresponds to the next smaller local minimum of expenditures (t_{nc}), leads to the decrease of the annual expenditures on the product (work) being produced in the amount of 3_{3r} .

Under these conditions the optimum service life will be equal to t_{np} years, if

$$3_{3p} = H_{rpt} - 3_{nt} > 3_{3r} \Delta t, \quad (3)$$

where $\mathfrak{Z}_{3r\Delta t}$ is the amount of the saving of national economic expenditures on the product (work) being produced by the equipment in case of the lengthening of its service life from year t_{np} to year t_{nc} ; Δt is the period of time in years from t_{np} to t_{nc} , that is, $\Delta t = t_{nc} - t_{np}$.

The value of $\mathfrak{Z}_{3r\Delta t}$ should be determined with allowance made for the time factor as the sum of the saving, which has been adjusted to year t , for the period $(t - t_{np}) = \Delta t'$ and $(t_{nc} - t) = \Delta t''$.

In case of a productivity of the equipment, which changes in time, we find the amount of the saving of national economic expenditures from the expression

$$\mathfrak{Z}_{3r} = \mathfrak{Z}_{hot_{np}} \frac{Q_{rt_{nc}}}{Q_{rt_{np}}} - \mathfrak{Z}_{hot_{nc}}, \quad (4)$$

where $\mathfrak{Z}_{hot_{np}}$ is the absolute value of the average annual costs of the consumer in case of the use of the equipment during the service life which is equal to t_{np} ; $\mathfrak{Z}_{hot_{nc}}$ is the same thing in case of a service life equal to t_{nc} ; $Q_{rt_{nc}}$ is the average annual volume of the product (work) produced by the equipment in case of a service life equal to t_{nc} ; $Q_{rt_{np}}$ is the same thing in case of a service life equal to t_{np} .

In case of an equal distance from year t of the closest local minimums of the expenditures, that is, in case $\Delta t' = \Delta t''$, the value of $\mathfrak{Z}_{3r\Delta t}$ is determined with great precision in the form of the product of \mathfrak{Z}_{3r} and Δt .

If as a result of the comparison of the values of \mathfrak{Z}_{3p} and $\mathfrak{Z}_{3r\Delta t}$ it turns out that $\mathfrak{Z}_{3p} < \mathfrak{Z}_{3r\Delta t}$ and another excess of the annual expenditures on repair over the replacement value of the equipment occurs before the occurrence of the absolute minimum of the national economic expenditures on the product (work) being produced by the equipment, the making of comparative calculations, which are analogous to the one set forth, for the finding of the next local minimums of the expenditures is the next step in the determination of the optimum service life.

The question of the dynamics of the replacement value of the equipment in the process of its obsolescence (the first and second types) is of exceptional importance in the determination of the optimum service life. One must not link the depreciation of the equipment only with the appearance of more productive analogues, as is done at times. Although productivity is the leading qualitative parameter when evaluating the degree of obsolescence, it is necessary to take into account the change of all the technical and economic parameters which have an influence on the efficiency of the functioning of the equipment. Therefore, when determining the degree of depreciation of operating equipment it is necessary to know, to what extent the use of new, more reliable equipment decreases the expenditures on the performance of repairs and the national economic losses from breakdowns. The analysis made by us of the obsolescence of semiconductor power converter equipment showed, for example, that in spite of the output power of some types of this equipment, which was stable during the entire period of production, the operating converters undergo obsolescence, since the new converters have higher indicators of reliability and durability and smaller dimensions and weight. Therefore it is quite obvious that the degree of depreciation of operating equipment and accordingly its replacement value

should be determined on the basis of the change of the national economic expenditures per unit of the product (work) being produced, including the economic losses from breakdowns. Moreover, when calculating these expenditures the expenditures on planned repairs and the expenditures on repairs stemming from breakdowns should be distinguished within the operating costs. This requirement originates in connection with the need for the evaluation of the influence on the degree of depreciation of operating equipment of the increase of its reliability.

The replacement value is found from the condition of the equality of the values of the efficiency of the use of operating and new equipment, that is, from the condition of the equality of the expenditures and economic losses from breakdowns per unit of the product (work), which is produced by means of operating and new equipment:

$$\frac{3_{nt}(E_n + P_{ac}) + I_{nct} + I_{act} + I_{dct} + H_{nct} + H'_{act}}{Q_{nt}} = \frac{3_{nn}(E_n + P_{an}) + I_{nn} + I_{an} + I_{dn} + H_{nn} + H'_{an}}{Q_{nn}}, \quad (5)$$

where 3_{nn} is the value of the new equipment; P_{ac} is the norm of the amortization deductions for the complete replacement of the operating equipment in parts per unit; P_{an} is the same thing for new equipment; I_{nct} is the average annual current costs of the consumer for the performance of planned repairs of operating equipment during the service life which is equal to t ; I_{nn} is the same thing for new equipment; I_{act} is the average annual current costs of the consumer for the performance of emergency (unscheduled) repairs of operating equipment during the period of time, which is equal to t ; I_{an} is the same thing for new equipment; I_{dct} is the average annual amount of the current operating costs of the consumer in addition to the expenditures on the performance of planned and emergency repairs of operating equipment during the period of time, which is equal to t (without the inclusion of the expenditures on renovation); I_{dn} is the same thing for new equipment; H_{nct} is the average annual amount of the economic losses for the national economy from breakdowns of operating equipment during time t ; H'_{act} is the average annual amount of the standard impact, which is obtained as a result of the use in the process of the operation of the equipment of national economic resources (without the inclusion of the standard impact of the value of the equipment itself), during time t ; H'_{an} is the same thing for new equipment; Q_{nn} is the average annual productivity of the new equipment.

Hence we find the replacement value of operating equipment during any year t :

$$3_{nt} = \frac{Q_{nt}}{Q_{nn}} \left[\frac{3_{nn}(E_n + P_{an}) + I_{nn} + I_{an} + I_{dn} + H_{nn} + H'_{an}}{E_n + P_{ac}} \right] - \frac{I_{nct} + I_{act} + I_{dct} + H_{nct} + H'_{act}}{E_n + P_{ac}}. \quad (6)$$

The calculation of the replacement value is based on the same initial data which are necessary for the calculation of the economic impact of the improvement of the quality of equipment. Therefore the evaluation of the degree of depreciation of operating equipment in any sphere of use is possible at the same time as the making of such calculations. If the improvement of the quality found expression in the increase of the indicators of the reliability of the equipment, the functional dependences of I_a and H_n on these indicators, which are proposed in work [6], can be

used for the estimation of the probable expenditures of the consumer on unscheduled repairs and the amount of the national economic losses from breakdowns.

There are different opinions on the question of when the depreciation of operating equipment under the influence of obsolescence occurs. We believe that the correct settlement of this question is possible on the basis of the consideration of the rate of the planned distribution of new equipment among the spheres of its use. During the initial period of the production of higher quality equipment for the purpose of achieving the greatest economic efficiency of its use it is necessary to channel it into those spheres, where the greatest economic impact is achieved [5]. Therefore during the period of the saturation of the need of the most efficient sphere of use the equipment operating only in this sphere undergoes depreciation. During the period of the meeting of the need of the next sphere of use in the level of efficiency depreciation encompasses the equipment which is used in this second sphere and so on. It is allowed that in individual spheres of use the depreciation of the equipment might also not occur, no matter what high qualitative parameters the new equipment has. This occurs when the higher qualitative parameters of the new equipment are not used to the full extent in this sphere of use, that is, when an economic impact of the use of the new equipment in this sphere is absent. In these instances the use of new equipment does not have an influence on the service life of operating equipment.

The existence of spheres of use of equipment, which differ in efficiency, and of differences in the degree of depreciation of operating equipment in each of them attests that several values of the optimum service life, which correspond to the specific conditions of operation, can be found for the same type of equipment. This testifies to the advisability of establishing ranges of the values of the norms of amortization deductions for the complete replacement of the value of the equipment on the basis of the possible values of its optimum service lives. The establishment of ranges of values of the amortization deductions promotes the pursuit in each sphere of use of a flexible local amortization policy, which ensures the optimum times of the replacement of operating equipment.

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